THE UNIVERSITY OF MELBOURNE

Melbourne School of Engineering

ENDEAVOUR EXHIBITION 2018

Engineering and IT for the future

Program guide

For more information, visit
endeavour.unimelb.edu.au
#endeavouruom

CONTENTS

WELCOME TO ENDEAVOUR

The Endeavour Exhibition is an annual showcase of industry, design and research projects developed by University of Melbourne engineering and IT masters students.

Led by the Melbourne School of Engineering, the Endeavour Exhibition provides a platform for final-year students to demonstrate innovative thinking through projects that tackle industry problems, improve processes and have commercial applications.

By showcasing some of the brightest minds and future-thinkers, the Endeavour Exhibition aims to inspire industry, the community and future students with the impact engineering and IT has on our lives and on future technologies.

DIRECTOR'S WELCOME

I'd like to welcome you to the Endeavour Exhibition and invite you to join us in celebrating the achievements of our wonderful engineering and IT masters students.

At this exhibition you'll get to meet our innovative and talented future engineers and discuss their final year projects with them.

Throughout the year, our students have developed projects in partnership with industry, government and not-for-profit organisations. These projects have real-world applications and help find solutions to all sorts of problems, from everyday process improvement through to life-saving innovations. These projects showcase the diverse talents of our students; they necessitate creativity, attention to detail, entrepreneurism and hard work. I encourage you to meet with our students and discuss these innovative projects with their ingenious inventors.

I would also like to thank our sponsors IEEE, Research, Innovation and Commercialisation, Wade Institute and Imbue Capital. I'd also like to extend special thanks to our partner Defence Force Recruiting and donor IMarEST for their contribution to Endeavour and to the Melbourne School of Engineering Foundation Board for their continued support. This support allows our students to undertake high-quality projects with the potential for real-world application.

Professor Andrew Ooi
Associate Dean,
Student Engagement
Melbourne School of Engineering
University of Melbourne

SPONSORS, DONORS AND PARTNERS

Thank you to our sponsors, partners and donors for their contribution to Endeavour and support of our project students. Their generous support helps make the Endeavour Exhibition possible, and through their contribution to a broad range of awards presented at the Endeavour Awards Night, enables our students to connect with industry and take the next step toward commercialising their projects.

The Melbourne School of Engineering Foundation Board plays a vital role in bringing together the School's community to develop a culture of philanthropy and engagement.

The Board is focused on generating financial and community support for the School through relationships with industry, alumni and other groups that are interested in the Melbourne School of Engineering's growth and development.

Thank you to the Board for contributing and supporting the People's Choice Award and the Endeavour Best Project Awards presented to the following disciplines:

- Best Project in Biomedical Engineering
- Best Project in Computing and Information Systems
- Best Project in Electrical and Electronic Engineering
- Best Project in Infrastructure Engineering
- Best Project in Mechanical Engineering
- Best Project in Mechatronics Engineering

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IMBUE CAPITAL

Sponsor of the 2018 Imbue Capital Award.

IEEE VICTORIAN SECTION

Sponsor of the 2018 IEEE Award for Technical Innovation and Engineering Achievement.

THE UNIVERSITY OF MELBOURNE

Sponsor of the 2018 Endeavour, Research, Innovation and Commercialisation Prize.

WADE INSTITUTE

Sponsor of the 2018 Wade Institute Entrepreneurship Award.

DONORS

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Thank you for IMarEST's contribution to the 2018 IMarEST Endeavour Award.

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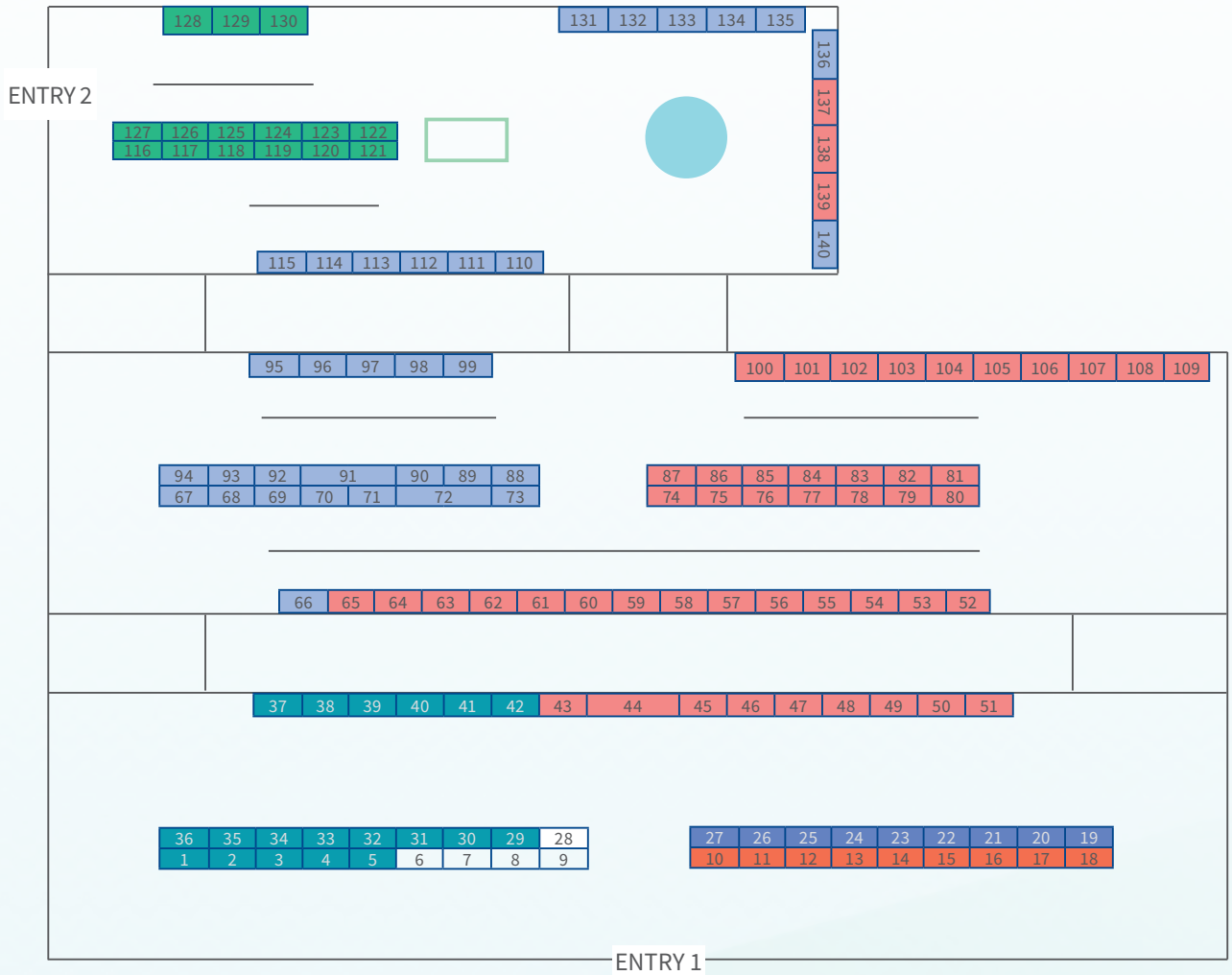
Thank you to Defence Force Recruiting for their support of Endeavour.

UNIVERSITY OF MELBOURNE MAP

Endeavour Exhibition

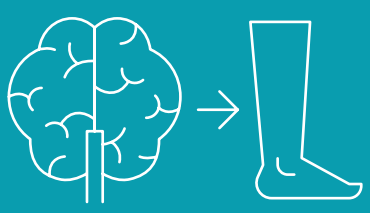
ENDEAVOUR EXHIBITION FLOOR PLAN



Registration Booth

	Biomedical Engineering		Electrical and Electronic Engineering
	Computing and Information Systems		Mechanical Engineering
	Infrustructure Engineering		Mechtronics Engineering

6	Wade Institute	7	Imbue Capital
8	Defence Force Recruiting		Australian Turntable Company
9	Research, Innovation and Commercialisation		



BIOMEDICAL ENGINEERING

To meet the health challenges of the future, we need the interdisciplinary skills and knowledge of biomedical engineers. As life expectancies increase, biomedical engineers are blending biomedical science with engineering to ensure our bodies can take us further than before.

At Endeavour, you can explore how our biomedical engineering students are creating new medical devices or solving clinical problems to help patients in need.

A BIOMECHANICAL EVALUATION OF A NOVEL DENTAL IMPLANT DESIGN CONCEPT

Booth number: 1
Supervisor: Dr David Ackland
Group members: Veronica Cooke, Gautam Latheesh

Dental implants are a popular replacement for compromised and unsalvageable teeth. The traditional implantation protocol involves extraction of the tooth and waiting for 6-12 weeks for the alveolar bone to heal, which often leads to bone loss. The objective of this project is to develop a personalised 3D-printed dental implant that can be implanted immediately after tooth extraction. This study will quantify the load response of the new implant in fresh-frozen cadavers using mechanical testing methods and use the data to validate a finite element model of the implant. The results of this pilot biomechanical study will indicate the feasibility of using personalised 3D-printed implants as replacements for conventional prosthodontic devices.

SEPSID - A SMART RISK FORECASTING SYSTEM FOR SEPSIS DEVELOPMENT IN HEALTHCARE

Booth number: 2
Supervisor: Professor David Grayden
Group members: Ashley James, Matthew Lowe, Carmen Verdeyen, Yifan Zhang

Sepsis is a reaction in the body to infection that kills 5000 people annually in Australia, four times more than the national road toll. It's difficult to detect and when untreated chance of death increases 7.8% hourly. CYAMedical have developed a smart risk forecasting system using real-time vitals monitoring and artificial intelligence to alert for earlier clinical intervention. The system has potential to significantly reduce morbidity and mortality rates, as well as saving costs. We have collected data on hundreds of sepsis patients and analysed the condition with machine learning. We have also conducted a pilot study, testing a device on patients in the ICU.

PREDICTING AGITATION IN DEMENTIA PATIENTS

Booth number: 3

Supervisor: Professor David Grayden

Group members: Andrew Bauer, Johnny Le, Sugan Ramasamy, Jessica Tran, Justin Villasin

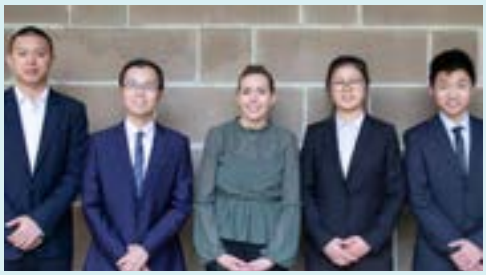
This project aims to investigate how physiological measurements are correlated to behavioural agitation in dementia patients. Agitation affects 85% of dementia patients with approximately 362,000 people affected in Australia in 2018. When left unattended, patients may become physically or verbally aggressive, which can cause harm to themselves and surrounding people. With the increased functionality of wearable devices, a medical grade wristband was used to measure various physiological signals to correlate to agitation in a simulated environment. Through these measurements, a predictive algorithm was built, which will allow for early intervention and improved health outcomes.

NOVEL DESIGN TO REDUCE PERIPHERAL INTRAVENOUS (PIV) LINE COMPLICATIONS IN NEONATES

Booth number: 4

Supervisor: Professor David Grayden

Group members: Yuanyuan Cui, Chao Guo, Junxiang Ren, Rachel Stirling, Jiaping Wu



Peripheral Intravenous (PIV) therapy is a common procedure performed to administer nutrition, antibiotics, and other necessary fluids through a catheter. The most common complications in PIV therapy are infiltration and extravasation, where the infiltrating fluid leaks into the surrounding tissue instead of the vein. This phenomenon occurs in 57-70% of neonates that receive PIV therapy and can result in tissue necrosis and even amputation. To mitigate the risk, this project developed a novel, cost-effective catheter that targets the most common causes of infiltration and extravasation.

InCora: A NON-INVASIVE METHOD TO MEASURE PRESSURE INSIDE THE HEAD

Booth number: 5

Supervisor: Professor David Grayden

Group members: Laura Gabriela Castro Peña, Eric Zunliang Liew, Kulaghan Kumaradevan, Rowan Seeley, Chandra Yerrappa

There are 70 million traumatic brain injuries globally each year, which have the risk of high pressure inside the head and can lead to brain damage and death. Monitoring this pressure is crucial in aiding doctors for diagnosis and treatment. Currently, the only way to do this accurately is to drill a hole into the skull and place a catheter in the brain. We are creating a device to measure this pressure without surgery, making it more accessible for millions of people.

IMPROVING THE ACCURACY OF RESPIRATORY SUPPORT TREATMENTS FOR PREMATURE INFANTS

Booth number: 29

Supervisor: Professor David Grayden

Group members: Edward Buijs, Seetal Erramilli, Lorinda Hartley, Alan Haszard, Amy Yu

In the developed world, respiratory distress syndrome remains the most common single cause of death within the first month of a newborn's life. Non-invasive respiratory support methods, such as Continuous Positive Airway Pressure (CPAP) and High Flow, are the current gold standards to treat respiratory distress in infants. However, due to leaks in the respiratory system, the pressure delivered by these machines is not necessarily the pressure actually delivered to the lungs. The ambiguity around what pressure is actually being delivered may result in delayed and/or incorrect clinical decisions. We have designed a device to enable the delivery of the desired pressure to the lungs of neonates on non-invasive respiratory support, to reduce the incidence and impact of further respiratory complications.

ALGORITHM TO INTERPRET SIGNALS FROM A SMART NASOGASTRIC TUBE (NGT)

Booth number: 30
Supervisor: Edward Green
Group members: Kuang-Yi Hsu

SWADE Medtech is developing a Smart Nasogastric Tube (NGT) with embedded sensors to detect correct and incorrect positioning during insertion of the device. The aim of this project is to develop an algorithm with SWADE Medtech which processes the signals provided from each of the two sensors in real time and thus detect correct and incorrect NGT placement during the insertion procedure.

TISSUE ENGINEERING A BLOOD VESSEL FOR RECONSTRUCTIVE SURGERY

Booth number: 31
Supervisors: Dr Daniel Heath, Dr Giovanna D'Abaco, Associate Professor Andrea O'Connor
Group members: Emma Moore, Yu-Ling Shen

Current research in tissue engineering is showing great promise for reconstructive surgery. Surgeons are interested in engineered tissue for transplantation into patients for wound healing. However, growth of tissue in-vitro to clinically-relevant sizes is limited due to the lack of a sufficient blood vessel system - the vascularisation. This is essential for the supply of oxygen and nutrients for cell survival in tissue constructs. Despite current research into the vascularisation of tissue constructs, it remains a significant challenge and is largely limited to in-vitro study purposes. Our project's goal is to enable constructs to be used for clinical applications such as in-vivo implantation. This can be achieved with a biofabricated tubular structure that can connect the engineered tissue to the body's natural blood supply. In this project, different biofabrication methods have been investigated and explored. Gelatin methacrylate (GelMA) is a promising material due to its tunable physical and biochemical properties. We synthesised cell-laden GelMA of different properties, and tested cell viability, rheology and mechanical strength. This will enable us to optimise our blood vessel tissue construct for its clinical application.

AUTOMATED MAPPING OF GUT MOTILITY IN A MOUSE MODEL OF AUTISM

Booth number: 32
Supervisors: Dr Elisa Hill, Associate Professor Leigh Johnston
Group members: Boglarka Ropolyi

The enteric nervous system regulates movement of food along the gastrointestinal tract via a series of orchestrated muscle contractions. Neurophysiologists study mouse gut tissue ex vivo using video imaging to observe gut behaviour under normal and pathological conditions. Currently, a large component of the analysis process workflow is performed manually. In addition, more detailed information about the types of contractions and their location along the gut is needed. The aim of this project is to advance the algorithms that automate mapping of contractions and improve understanding of regional differences in gut motility using signal processing techniques such as Fourier and wavelet analyses.

MAPPING IRON IN THE BRAIN

Booth number: 33

Supervisor: Associate Professor Leigh Johnston, Dr John Clearly, Dr Scott Kolbe, Associate Professor Brad Moffatt

Group members: Chengchuan Wu, Yicheng Zhang

Excessive iron accumulation (iron overload) in the human brain is associated with neurodegenerative diseases, such as Alzheimer's disease, Parkinson's disease and Multiple Sclerosis. Quantitative Susceptibility Mapping (QSM) is an increasingly popular technique for inferring the presence of iron in the brain from Magnetic Resonance Imaging (MRI) data. This project proposes a method to remove artefact and improve image accuracy. Simulation and healthy subject data from an ultra-high field (7T) MRI scanner are used for validation and to provide insight for future research. In addition, this improved method is used to process additional subject data with neurodegenerative disease for future research.

COMPARING TRANSTIBIAL PROSTHETIC SOCKETS GEOMETRY SHAPE UNDER VARIED CASING CONDITIONS

Booth number: 34

Supervisor: Professor Peter Lee, Sheridan Liang

Group members: Xingyi Chen, Jegadeesh Murugan

This project compares the geometry shape of different transtibial prosthetic sockets using various casing conditions. From these measurements, the appropriate socket that can be used for patients can be found.

IMPROVING ARTICULAR CARTILAGE REPAIR OUTCOMES WITH 3D PRINTING AND TISSUE ENGINEERING

Booth number: 35

Supervisor: Associate Professor Andrea O'Connor

Group members: Lanyita Lu, Peilin Tian

Biopen is a world-first innovative bioprinting strategy, based on simultaneous co-axial 3D printing of biomaterial and stem cells that can be performed during surgery. Preliminary results of both in vitro and in vivo studies for biopen-generated bioscaffolds are promising. However, the lack of bonding properties between the scaffold and the host cartilage leads to fibrocartilage formation and failure of the technique in the long term. The goal of this project is to develop strategies to obtain a fast, strong and long-lasting adhesion between the bioprinted bioscaffold and the host tissue. This will ultimately improve integration and performance of regenerated cartilage in the long term. This project is also related to another project team in biomedical engineering (Project Name: Effect of crosslink density and stiffness on the chondrogenesis of MSCs in hydrogels, booth 36, see page 13).

EFFECT OF CROSSLINK DENSITY AND STIFFNESS ON THE CHONDROGENESIS OF MSCS IN HYDROGELS

Booth number: 36

Supervisors: Associate Professor Andrea O'Connor, Dr Serena Duchi, Dr Cathal O'Connell, Dr Carmine Onofrillo

Group members: Xin Li, Yifan Zhang

BioFab3D is a research group focused on combining the latest technology in 3D printing with leading medical research. A recent development of BioFab3D is the Biopen—a handheld bioprinting device for use in surgery. By depositing a 'perfect-fit' scaffold of cells and biomaterials, the Biopen holds great promise in treating osteoarthritis and regenerating long lasting cartilage tissue. This project, located in BioFab3D involves screening and testing of the biomaterials to support the growth and differentiation of cells.

In the Biopen project, the hypothesis is that the damaged knee cartilage could be repaired by depositing patient-derived stem cells, encapsulated in a suitable bioscaffold, to fill the defect site. To achieve cartilage repair, the cells need to differentiate into chondrocytes and remodel the material into natural cartilage matrix. In this study, we investigate crosslink density and stiffness on the chondrogenesis of mesenchymal stem cells in hydrogels. This project is sponsored by and located in BioFab3D, which is a facility of Aikenhead Centre for Medical Discovery (ACMD). This project is also related to another project team in biomedical engineering (Project Name: Improving articular cartilage repair outcomes with 3D printing and tissue engineering, booth 35, see page 12).

CAN WE MEASURE TISSUE COMPOSITION FROM NON-INVASIVE BIOMECHANICAL MEASUREMENTS?

Booth number: 37

Supervisors: Associate Professor Andrea O'Connor, Dr Vijay Rajagopal

Group members: Anu Sabu

Different parts of the body are made of different tissue types. Changes to the composition of certain tissues can be an indicator of disease progression. The aim of this project is to see if non-invasive biomechanical measurements can be used to track changes in tissue composition.

VAGAL NERVE STIMULATION: TREATMENT FOR INFLAMMATORY BOWEL DISEASE

Booth number: 38

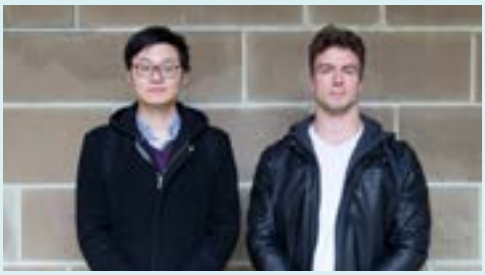
Supervisor: Dr Sophie Payne

Group members: Cornelius Bosco Paul, Madhura Nagesh Mahamunkar

This project aims to develop technology and methodology around creating a feedback-controlled, neuromodulation system that provides therapeutic benefits by regulating peripheral neural circuits. Stimulation of the vagus nerve is a novel, emerging therapy for inflammatory bowel disease (IBD). Electrophysiological experiments and anatomical studies undertaken can provide patient specific treatment to a disease that is episodic in nature. This project is aimed to investigate whether vagal tone can be used as a biomarker of inflammatory bowel disease.

BIOMECHANICS OF CARDIAC CELL CONTRACTION

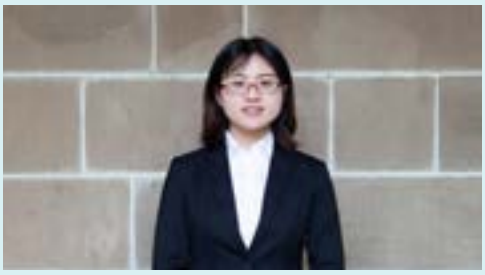
Booth number: 39
Supervisor: Dr Vijay Rajagopal
Group members: Nathan Isles, Yilun Zhu



This project aims to develop a biomechanical model of a single cardiac myocyte which describes its active and passive mechanics. Using the finite element method, the aim is to reproduce these characteristics not only for healthy cells, but also in cells which are in different diseased states. In developing such a model, it is hoped that a better understanding of the biomechanical impacts of disease on a healthy cardiac myocyte will be established.

DamID-seq DATA ANALYSIS

Booth number: 40
Supervisor: Dr Jan Schröder
Group members: Jue Jiang



DNA adenine methyltransferase identification (DamID) is a current method of identifying binding sites of chromatin proteins. DamID is ideal for low-expressed DNA-binding proteins, and this experiment can be conducted in vivo without using antibodies. However, DamID still poses challenges. For example, if the number of identified targets is too large, and the proportion of shared genes is low when comparing to previous studies. Therefore, improvements are needed in data analysis, such as filtering methods. In this study, the experiment results of DamID are used on trans-factors Yorkie and Scalloped, that promote organ growth and other complex biological processes in Driosophila. Then, based on the DamID experiment principles and knowledges of the trans-factors, several data analysis models are then built and estimated. These may help to construct a better protocol of DamID.

UNLOCKING THE POTENTIAL OF 3D BIOPRINTING

Booth number: 41
Supervisor: Dr Kathryn Stok
Group members: Joshua Gordon

3D bioprinting is an emerging field that has the potential for tissues, organs and other materials to be custom printed. After acquiring a state of the art 3D bioprinter, Dr Kathryn Stok and the mechanobiology team are now looking to expand the understanding of cartilage and mechanobiology through the use of bioprinting. Before this, the capabilities of the printer as well as the current materials and applications in bioprinting needed to be understood. From this foundational understanding, the possibility of printing collagen, elastin and ultimately cartilage is then explored for research and clinical purposes.

MODELLING NEURAL MECHANISMS OF BEE FLIGHT (BIOMEDICAL)

Booth number: 42
Supervisor: Professor David Grayden
Group members: Chenying Bian, Chang Liu

The neural and mechanical structures of the bee have been extensively studied over past decades to investigate how these insects maintain controlled flight and land safely. Bees control their speed by adjusting the rate of observed image motion, also known as optic flow. Research of different insects has also found reflexive and very fast corrections to maintain controlled flight. With the neural anatomy of bees already well-known, this project involves developing a neural model of the interactions between the brain and the wings of bees in an attempt to better understand the mechanisms of their flight control. This knowledge may lead to future guidance systems for miniature, biomimetic flying robots. This project was developed in conjunction with another project team in electrical engineering (Project Name: Modelling neural mechanisms of bee flight (electrical), booth 43, see page 17).


RFID-RC522

ELECTRICAL AND ELECTRONIC ENGINEERING

Electrical systems power our everyday lives, from energy efficient power grids to life-changing medical devices. Electrical and electronic engineers are integral to designing, building and managing these valuable systems, from large-scale telecommunications systems to small-scale smartphone devices.

Discover electrical engineering innovation at Endeavour, including drones, smart meters, gesture recognition, patient monitoring and an electric racecar.

MODELLING NEURAL MECHANISMS OF BEE FLIGHT (ELECTRICAL)

Booth number: 43
Supervisors: Professor David Grayden, Professor Dragan Nesic
Group members: Xinzhuo Hua, Xiaoyu Huang, Jiayi Ma

The neural and mechanical structures of the bee have been studied over the past decades to investigate how these insects maintain controlled flight and land safely. Bees control their speed by adjusting the rate of observed image motion, also known as optic flow. Extensive research of different insects has also found reflexive and very fast corrections to maintain controlled flight. Finally, the neural anatomy of bees is well known. This project will involve developing a neural model of the interactions between the brain and the wings of bees in an attempt to better understand the mechanisms of their flight control. This knowledge may lead to future guidance systems for miniature, biomimetic flying robots. This project was developed in conjunction with another project team in biomedical engineering (Project Name: Modelling neural mechanisms of bee flight (biomedical), booth 42, see page 14).

LOW-COST INDOOR LOCALISATION OF RC VEHICLES USING STEREO CAMERAS

Booth number: 44
Supervisor: Associate Professor Tansu Alpcan
Group members: Yuhao Su, Zhangyi Wang, Dongwei Yu

Our project aims to develop a low-cost indoor localisation system. This system will use stereo cameras mounted on vehicles and open-source toolkits such as OpenCV. By using easy-to-recognise visual markers on vehicles and in the environment, the stereo cameras can identify the markers and measure the distance. The data will then be processed by a Raspberry Pi system to locate vehicles.

RF-BASED LOCALISATION IN CONTESTED ENVIRONMENTS USING GAME THEORY

Booth number: 45
Supervisor: Associate Professor Tansu Alpcan
Group members: Zhixin Bao, Jikun An

This project aims to find a radio node lost in a pre-defined area using radio signals. A network of user-friendly software-defined radio (SDR) receiver nodes collaborate with each other to locate the lost node using pseudo-doppler or beamforming antenna arrays. It is assumed that there are adversarial nodes in the same area, who hide from the SDR receivers and jam the signal of the lost node. Building upon a previous project, this project starts with a quick system integration involving RTL-SDR receivers and a laptop. The first challenge is to design and implement a pseudo-doppler or beamforming receiver node for partial localisation. The subsequent goal is to develop a network of such nodes to find the lost radio node and avoid jamming by the adversary.

DETERMINING MATURITY OF WATERMELON FRUIT USING NON-DESTRUCTIVE METHODS

Booth number: 46
Supervisor: Associate Professor Tansu Alpcan
Group members: Christopher Jury, Ranjaka De Mel, Daniel Schulz

Using a combination of sensors, single-board computers and deep neural networks, this project automatically determines the ripeness probability of watermelon fruit, based on data collected from an operational watermelon farm. This project aims to reduce wastage and provide an easier method for pickers to identify melons correctly. This is an industry partnered project, with Daintree Fresh Pty Ltd.

OPTIMISING THE SCHEDULING OF OPERATIONS IN AN UNDERGROUND MINE

Booth number: 47
Supervisor: Associate Professor Marcus Brazil
Group members: Chajin Ke, Yihao Yang, Yichi Zhang

This project seeks to address designing and scheduling underground mines, a problem that poses practical implications for the mining industry. The team will initially design and implement an optimisation algorithm for a single drilling rig that will be able to develop multiple faces at a time. This algorithm will be applied to real data and extended to encompass multiple sets of drilling equipment. This project has involved the collaboration and consultation with industry collaborator, Rand Mining.

ELECTRONIC VOTING RESPONSE SYSTEM

Booth number: 48
Supervisor: Dr Gavin Buskes
Group members: Yigang Liang, Tong Tong, Ziyi Xiong

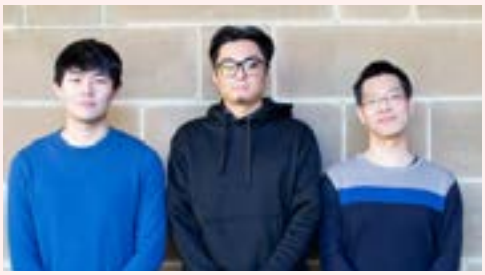
Electronic voting response systems (EVRS) are used in large classes as a means of promoting student engagement through participation in quizzes and surveys and allowing students to provide instant feedback during lectures. These types of systems are typically costly and therefore difficult to roll out to a large subject with many students. This project serves to develop the hardware, including constructing small, relatively low-cost push button wireless controllers; a receiver base station that can receive many transmitters' responses in a short period of time; and the software to record the student response data and potentially display it on the lecture screen in real time.

MULTI-ROOM MUSIC SYSTEM

Booth number: 49

Supervisor: Dr Gavin Buskes

Group members: Zhexun Chen, Junting Lu, Shuai Yuan



This project seeks to design a small receiver module that can act as a music sink and stream music from a network storage location. The module will permit connection directly to small speakers or an external amplifier via a line out, enabling multiple receiver modules to be synchronised and placed throughout a house. Furthermore, zones can be set up to simultaneously play specific playlists in certain areas, for example, party music for an outdoor receiver and quiet relaxing music for indoors. The music system will be controlled via a web interface, which allows configuration of the zones, level adjustments and playlist selection for authenticated users via mobile or wireless devices.

HYBRID UNMANNED VEHICLES WITH DYNAMIC MESH NETWORKING

Booth number: 50

Supervisor: Dr Airlie Chapman

Group members: Sam Barrett, Andras Hazi, Donald Kirk

Disaster relief efforts often involve searching partially collapsed structures for survivors. Unmanned vehicles can be invaluable in these situations although current solutions have severe limitations; ground vehicles are impeded by stairs and debris, while aerial vehicles have a short run-time and are not robust to collisions. Existing solutions also struggle to maintain wireless communications with the operator in these obstructed environments.

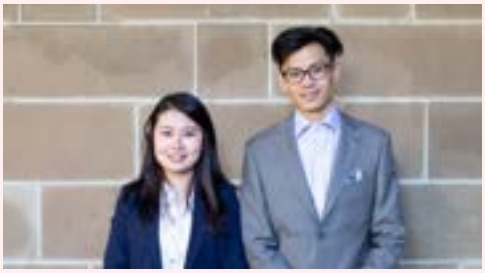
This project modified an existing drone to address these issues. A rolling cage was added, improving robustness and movement efficiency while still allowing flight. A high-bandwidth wireless mesh network was implemented, halting the vehicle and enabling it to act as a relay node for another vehicle to continue operations during low signal strength.

SENSING PH WITH A LAB-ON-A-SMARTPHONE FLUORESCENCE SPECTROMETER

Booth number: 51

Supervisor: Professor Ken Crozier

Group members: Yuxuan Li, Zixiang Ren



Lab-on-a-Smartphone Fluorescence Spectrometer is a portable and cheap pH value measurement iPhone attachment which uses iPhone 5s to analyse and indicate the pH value with a high accuracy of ±0.1 error. The dye-mixed sample contained by cuvettes is set in the iPhone attachment. After irradiating with a low-power laser through the cuvettes, the smartphone image sensor records the fluorescence spectrum, and the application displays the pH value to user. Since the pH level of saliva can indicate oral health situation, this design can be applied to for medical use. Compared with the traditional spectrum analyser, which requires professional training before the operation, this design is easier to operate and learn.

EFFICIENT HIGH-PRECISION THREE-PHASE MULTILEVEL DC/AC INVERTER

Booth number: 52

Supervisor: Associate Professor Peter Dower

Group members: Lewis Hickey, Anthony Kremor, Shaun Pye

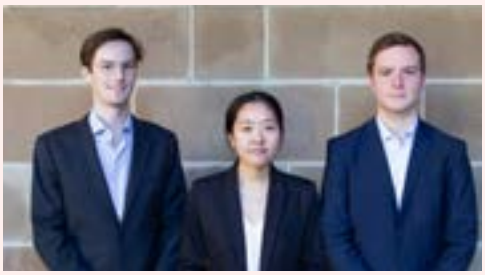
This project presents a three-phase inverter system prototype, is presented which demonstrates a multilevel architecture that converts DC power to AC with both high efficiency and high precision. The system architecture is both modular and scalable and therefore finds use in a variety of power electronics applications, ranging from distributed power grids through to electric vehicles. A closed-loop control system further extends the system to be configurable and adaptable to a wide range of loads and motor applications.

A SCALABLE ULTRA-CAPACITOR CHARGE MANAGEMENT SYSTEM

Booth number: 53

Supervisor: Associate Professor Peter Dower

Group members: Liam Van Hees, Miu Ito, Oscar Salt



The advancement of ultra-capacitor technology and manufacturing techniques has led to them being a viable alternative to conventional batteries in many applications. Limitations exist in ultra-capacitor implementation of charge storage and delivery by way of low cell terminal voltage and the dependence of this voltage with stored energy however.

This project presents a kind of charge management system that all ultra-capacitor implementations require and provides a guaranteed DC voltage supply with known recharge and discharge characteristics. The physical modelling, electronics and programming used is unique to a particular set of performance goals and would be relevant to much larger systems.

COMMUNICATION WITH ALCOHOL MOLECULES

Booth number: 54

Supervisor: Professor Jamie Evans

Group members: Hanfei Bao, Muhammad Sufiyan, Hanhao Wang

Molecular communication is a different form of communication in which information is encoded onto (and decoded from) molecules rather than electrons or electromagnetic waves. This project aims to develop hardware and software that facilitates digital communication between two points using alcohol molecules. Although this is considered a new form of communication, it has long been used all around us: it is the primary method of communication among microorganisms, including the cells in the human body.

EMBEDDED WIRELESS ACCELEROMETERS FOR SPORTING APPLICATIONS

Booth number: 55

Supervisors: Professor Jamie Evans, Dr Sam John

Group members: Cen Liu, Huabing Lou, Chenpeng Lu

The project aims to design and build a wireless accelerometer that can be used in sporting activities. For example, it can be placed on the body of a player or inside a football to track the movement of the player or the football and display related information on a computer.

INDUCTIVE COMMUNICATION USING COILS IN A MULTILAYER PCB FOR HV BATTERIES

Booth number: 56

Supervisor: Professor Rob Evans

Group members: Wentao Huang, Zheng Li, Xuehao Xu

Relectrify is an agile fast-moving start-up company that makes energy storage affordable by reusing discarded cells out of old electric vehicles. This project will look at the possibility of using coils built into a multi-layer PCB for inductive communication between two microcontrollers, allowing for very low-cost communication capable of 500V. This is a very hands-on project, where the team works closely with Relectrify.

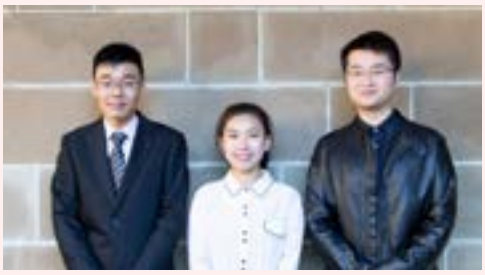
LOW-COST 3D LIDAR SYSTEMS

Booth number: 57
Supervisor: Associate Professor Brian Krongold
Group members: Zhaoxuan Huang, Shiyu Wang, Xuetong Wu

The project aims to build a low-cost 3D LiDAR, which consists of a Raspberry Pi, servo motor, laser and small camera. The device will rotate, allowing the camera to capture the image data of the surrounding environment which contains the reflected laser line. With these data, we can undertake 3D mapping and scene reconstruction. This design can be applied to practical applications such as object detection, 3D environment scanning and barrier detection for a small moving robot. This project is sponsored by Capgemini.

ON-THE-GO GESTURE RECOGNITION

Booth number: 58
Supervisor: Associate Professor Brian Krongold
Group members: Shijie Jiao, Jialing Tong, Yicheng Yu



Gesture recognition (GR) is an important tool that enables customers to interact freely with technology. As most GR sensors are not portable and require line-of-sight, they have limited functionality and practicality. By overclocking the standard accelerometers, it is possible to map complex gestures on-the-go with a wrist-wearable device designed to collect movement and gesture data from the user. This project is being sponsored by Capgemini.

HEART RATE MONITOR

Booth number: 59
Supervisor: Professor Christina Lim
Group members: Ding Li, Mengxuan Su

A heart rate monitor will help track the intensity of a workout and how the body responds to physical activity. Optical heart rate monitors have become popular these days because of its compactness and straight forward integration with wristwatches. This technique is based on measuring the heart rate using light sensors that reads the amount of oxygen in the blood (Photoplethysmography method).

WELL-BEING MONITORING FOR ELDERLY CITIZENS

Booth number: 60
Supervisor: Professor Christina Lim
Group members: Xiruo Cheng, Shijia Guo, Chun Hean Ng

Many elderly people can suffer from accidental falls. If medical attention is not given immediately, these accidents can have serious consequences. The aim of this project is to develop a new solution that uses a Pebble Watch to alert the user about a fall. The watch can communicate with a mobile phone or tablet running on either iOS (Apple) or Android (programs are available from developers site). This project will focus on the communication method between the device and a mobile phone or the method of triggering a phone call or text message to the relief personnel.

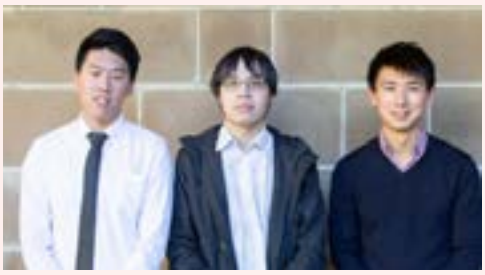
THEME PARK QUEUEING MONITOR FOR BETTER EXPERIENCE

Booth number: 61
Supervisor: Professor Christina Lim
Group members: Yiting Cao, Yundou Li, Zhencheng Sang

Most theme parks only provide a standard queue time estimate on a board and do not convey real-time queue information. The lack of real-time feedback and actual location within the queue makes it difficult for tourists to determine how long it will take to experience a ride or other attraction. This project aims to develop a solution to this problem by using fixed barcode scanners and an APP application to tell provide tourists of the real-update time updates and their location in the queue.

AirPatcher: MODULE FOR WIRELESS UPDATES

Booth number: 62
Supervisor: Dr Jonathan Manton
Group members: Ivan Dang, Duy To Nguyen, Jack Zheng



Wireless firmware updates will soon become an essential feature for any product. AirPatcher is a low-cost Wi-Fi connectivity solution that provides firmware updates over the air (FOTA) for host microcontrollers. It has been engineered to allow specialised microcontrollers, such as the Microchip dsPIC30/24 range, to securely receive firmware updates. AirPatcher enables products to be upgraded with Internet of Things functionality without costly redevelopment times and reduces the time to market for connected products. AirPatcher provides a small hardware module which is easy to integrate and a web application for managing your devices.

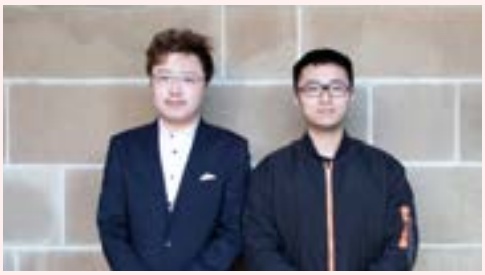
SIMULATING TENNIS TACTICS

Booth number: 63
Supervisor: Dr Jonathan Manton
Group members: Yuetao Wu

This project aims to develop a range of mathematical models for tennis player, growing in complexity. Each model will have an internal state representing the physical and mental state of the player based on the trajectory and spin of the incoming ball and the current location of the player. This model will determine the accuracy of the different types of shots the player can hit. A strategy determining what shot a player will try to play in any given situation will be applied, enabling a tennis match to be simulated between two players.

UNMANNED GROUND VEHICLE (UGV) AND HUMAN TEAMING

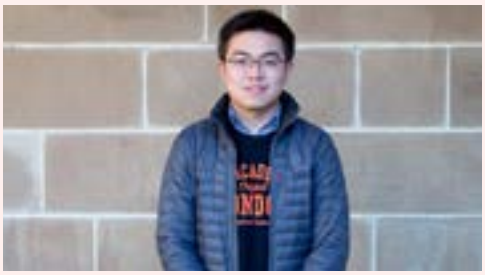
Booth number: 64
Supervisor: Professor Chris Manzie
Group members: Binghan Li, Sining Li, Haotian Xia



This project involves designing a system where a human operator will identify a specific target and guide one or more unmanned ground vehicles (UGVs) to the target. The UGVs will have the ability to navigate around obstacles and distinguish the target from nearby objects. The UGVs will then have to communicate back to the human operator for further instructions and carry them out.

AUTONOMOUS RACING CAR DESIGN BASED ON ROBOTICS OPERATING SYSTEM (ROS)

Booth number: 65
Supervisor: Professor Chris Manzie
Group members: Guanghui Ma, Xuze Wang, Ruolin Zhou



Self-driving cars are cars with the ability to detect their surrounding environment through sensors and navigate themselves without human assistance. Our sponsor The Robotics Club hosts a self-driving car racing event every year, dozens of teams will take part in this competition. The model cars in this competition have to reach a destination as fast as possible and attack the other competitors during the race. This project will divide the whole system into object detection, PID controller and navigation parts and will offer different schemes available for each task and organise them in Robotics Operating System (ROS) to check their cooperation and performance.

INTERFACE DEVELOPMENT FOR MACHINE LEARNING OF AUTOMOTIVE CALIBRATION PRIORITIES

Booth number: 74
Supervisor: Professor Chris Manzie
Group members: Anthony Hidayat, Dexin Liu, Michael Warton

With diesel engines well-established and widely used within our society, engineers are constantly working to improve their control systems. In the last couple of decades, neural networks have become an effective way of determining the controller parameters for desirable responses. However, relevant data sets are required to generate these neural networks. This project aims to increase the production of data sets by providing a graphical user interface for users to generate data sets suitable for neural networks, specifically for diesel engines. Furthermore, with machine learning techniques and by querying the user to grade points with the most information first, the input required by the user has been reduced significantly.

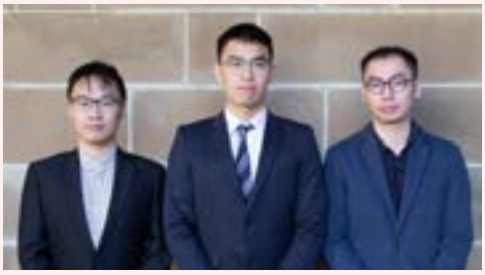
PERFORMING CONTROL WITH ENCRYPTED SIGNALS

Booth number: 75
Supervisors: Professor Michael Cantoni, Dr Farhad Farokhi, Dr Iman Shames
Group members: Kevin Ngo, Channa Dias Perera, Julian Tran

With the rising popularity of cloud platforms, data privacy and security have become more critical than ever before. Current secure control system methods require decrypting information before it can be effectively manipulated, which exposes the data to unauthorised access and theft. With data breaches becoming more frequent and damaging, investigating new techniques to process data whilst it is still encrypted will be vital to securing the digital future. This project explores the implementation of semi-homomorphic encryption algorithms on a Field Programmable Gate Array (FPGA) to control a dynamical system using encrypted signals.

AUTOMATING INTEGRATED VISUAL CUES AND VERBAL COMMUNICATION IN EMOTIONAL ANALYTICS OF SOCIAL DEBATES

Booth number: 76
Supervisor: Professor Thas Nirmalathas
Group members: Hongyi He, Kun Liu, Yi Xiao



This project uses machine learning to analyse people's attitudes and emotions in social debates. This project is comprised of three different parts. Firstly, this project builds a convolution neural network that will train the database to recognise peoples' facial expression in a video. The second part of the project uses text analysis to identify peoples' attitudes. In the third part, the project focuses on the audio signal analysis of the social debates. These three parts will then be combined to form an interactive system that shows the feedback of people's emotions.

GESTURE-DRIVEN USER INTERFACES FOR INTERNET OF THINGS

Booth number: 77
Supervisor: Professor Thas Nirmalathas
Group members: Dongli Huang, Mingming Zhang, Yibin Zhang

Gesture-driven user interfaces can be used to control and manage many systems and devices. This project involves building gesture and audio-driven interfaces that can interact with Internet of Things (IoTs). Specifically, implemented on embedded systems of a connected home where all appliances, devices and computers are interconnected.

INTELLIGENT MANAGEMENT OF ELECTRIC VEHICLE CHARGING IN CAR PARKS

Booth number: 78
Supervisor: Professor Nando Ochoa
Group members: Jorge Gonzalez, Wenwei Lin, Andrew Pemberton

The widespread adoption of electric vehicles (EVs) is expected to increase in the coming decade. While car parks are likely to provide infrastructure to charge EVs in the near future, the cost of simultaneously charging multiple vehicles could be prohibitive. This project investigates the most cost-effective infrastructure required to make a car park EV-ready. It explores the strategies and algorithms to intelligently manage EV charging so as to reduce the size of the network assets (conductors, transformers) and thus reduce cost. South Lawn car park is used as a case study. This project has been developed in partnership with Zinfra.

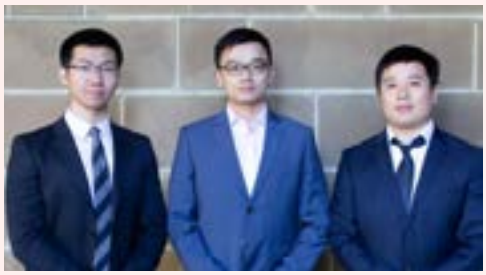
MONITORING AND CONTROL OF A CAMPUS VIRTUAL POWER PLANT

Booth number: 79
Supervisors: Professor Nando Ochoa, Professor Margreta Kuijper
Group members: Hao Chen, Litao Geng, Tian Qi

This project aims to design a basic model of a virtual power plant and apply it on campus. A virtual power plant is a simulated plant that could provide the same services as a physical power plant, which includes renewable energy sources, an energy storage system, distributed generators, a communication system and control system. Through adequate monitoring, and working with communication and control infrastructure, this model could control the demand as well as generation assets to adapt to the consumption profile.

WEARABLE PHOTOPLETHYSMOGRAPH (PPG) DEVICE TO MONITOR CARDIORESPIRATORY FUNCTION

Booth number: 80
Supervisor: Professor Marimuthu Palaniswami
Group members: Rui Han, Xingyan Han, Enze Zhang



Physiological signal acquisition with wearable devices is important for continuous and hassle-free monitoring, for use in both daily life or clinical settings. The aim of this project is to build a low-cost wearable PPG sensor device, which is capable of wirelessly transmitting data to a mobile phone. Firstly, this project will design and build a PPG sensor device with Bluetooth communication system. Secondly, the project will design and develop an Android application for mobile phones to collect, process and visualise the data.

REAL-TIME WIRELESS MONITORING FOR ICU PATIENTS

Booth number: 81
Supervisor: Professor Marimuthu Palaniswami
Group members: Abrar Ahmed, Nicholas Barbieri, Elaine Coventry

The Intensive Care Unit (ICU) is an important hospital department that admits patients who require close observation and monitoring. Some critically ill patients have limited or no mobility and are currently monitored via bulky equipment. This setup often creates a network of cables, which may become tedious and cause the patient further discomfort. The objective of this project is to develop a wireless patient monitoring system that eliminates the need for cables. This will consist of a portable hardware device to collect the patient's temperature, electroencephalogram (EEG), photoplethysmogram (PPG) and electrodermal activity (EDA). An Android application will be used to display and analyse this information over a wireless connection, improving ease of use for both patients and health professionals.

AIR QUALITY MONITORING IN URBAN ENVIRONMENTS

Booth number: 82
Supervisor: Professor Marimuthu Palaniswami
Group members: Boyang Cui, Xingzhuo He, Zezhi Zheng

Air quality is a growing concern in today's urban environments. Convenient, cleaner, smarter and cheaper methods for monitoring the environment are increasingly sought after. This project will develop an Android app to visualise real-time air quality data and provide relative recommendations on daily activities and alerts on abnormal conditions. Affordability and low power consumption will be achieved by using the Waspmote development kits and a lightweight framework database.

WINDOW WASHING DRONE

Booth number: 83
Supervisor: Dr Ranjith Rajasekharan
Group members: Edward James, Mathew Knight, Matthew Walker

Manual washing of skyscraper windows is unnecessarily dangerous. This project aims to develop a prototype drone-based window washing system with a view towards future commercialisation. This involves designing and integrating external hardware and developing navigational systems to accurately clean building windows.

DRONE-BASED SENSORS FOR POWER AND GAS INFRASTRUCTURE MONITORING

Booth number: 84
Supervisor: Dr Ranjith Rajasekharan
Group members: Didi Chi, Hongyi Guo, Yi Han

Electricity and gas are transported over long distances and in remote locations. Monitoring, inspection and maintenance of power and gas infrastructure assets are crucial for safe operation. Recently, drone-based technology has been employed for various infrastructure inspection applications, particularly in remote or inaccessible locations. The effective use of drones requires sensors that are able to detect defective or malfunctioning equipment, and a stabilised platform with multi-sensors can achieve high performance. This project was sponsored by Zinfra.

AUTONOMOUS DRONES FOR DISASTER MANAGEMENT

Booth number: 85
Supervisor: Dr Ranjith Rajasekharan
Group members: Caleb Ballinger, Justin Lont, Andrew Regan

There is a great demand for fully autonomous drones for missions that are too dangerous or complex for humans. For example, a drone could scout a building under fire and send back vital information to assist firefighters before they enter. In collaboration with the Metropolitan Fire Brigade (MFB), this project will develop a drone that is capable of traversing unknown environments and obstacles as well as creating a floorplan and streaming a video feed, with minimal human operation. With no access to GPS, this drone implements laser scanners and a range of other onboard sensors to enable positioning and mapping.

IMPROVED COMMUNICATIONS MODULE FOR SMART METERS

Booth number: 86
Supervisor: Professor Margreta Kuijper
Group members: Aamer Mansoor Ahmad, Klay Robinson, Santhosh Krishna Dodleti Venkata

Current smart meters are very good at measurement and have basic communication capabilities. Typically, meters use a RS-232 port to connect with a modem or communications module to connect to carrier networks or other custom mesh networks. This project will build a new kind of module that incorporates these basic functions, but adds several new important capabilities, such as displaying the real-time electricity consumption on a computer or mobile phone, device recognition by observing power usage characteristics, local temperature measurement and remotely controlling home devices through web applications. This project aims to realise a 'smart home' by implementing the concept of IoT (Internet of Things). This project has been developed in partnership with Metropolis Metering and is related to another project team in electrical and electronics engineering (Project Name: Build and extend a smart meter, booth 87, see page 26).

BUILD AND EXTEND A SMART METER

Booth number: 87
Supervisor: Dr Ranjith Rajasekharan, Professor Margreta Kuijper
Group members: Yanshan Liu, Jiachang Qian, Linghao Wu

This project involves designing and building an analogue front-end smart meter board with MSP430, Raspberry Pi zero w and LCD 1602. The 24 bits Sigma - Delta ADC of MSP430 sample voltage and current signal and send the samples to Pi Zero through UART. The samples are processed by Pi Zero to obtain the required information, such as active power, reactive power and power consumption. All these results will be stored in local database with security and the server can fetch the results from database by query for further analysis and application. This project has been developed in partnership with Metropolis Metering and is related to another project team in electrical and electronics engineering (Project Name: Improved communications module for smart meters, booth 86, see page 26).

NONLINEAR SENSOR FUSION FOR MULTI-VEHICLE TEAMS

Booth number: 100
Supervisor: Eric Schoof
Group members: Yi Xiao, Yunxin Yang, Han Zhang

It is important for multi-vehicle teams to have the ability to sense relative positional information about one another. Augmenting this information with active communication enables teams to perform sophisticated missions exhibiting with swarming behaviour. In this project, we aim to develop a novel low-cost device for small ground vehicles that can simultaneously sense and communicate with other vehicles. Range and orientation information can be determined from the signal's strength through a non-linear relationship. The specific objectives of this project are to firstly develop a nonlinear state estimator to fuse and process this information, and secondly implement and test the estimator on a pre-existing multi-vehicle ground team.

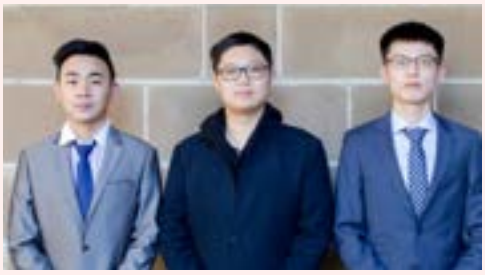
FORENSIC CAMERA MODEL IDENTIFICATION

Booth number: 101
Supervisor: Dr Karim Seghouane
Group members: Changmeng Lin, Hao Xiong, Bijun Zhu

This project aims to build a system capable of determining the camera manufacturer and model that captured a digital image without relying on metadata. To build the camera model identification system, this project will firstly design signal processing algorithms to extract forensic traces from digital images. It will then design machine learning algorithms to identify a camera model on the basis of these traces and train the systems on a large dataset of images. This project lies at the intersection of signal processing, machine learning and information security, and has been an important area of signal processing and information forensics research for more than a decade.

SOURCE SEPARATIONS FOR SIMULTANEOUS SEISMIC DATA ACQUISITION

Booth number: 102
Supervisor: Dr Karim Seghouane
Group members: Yu Chen, Xiang Li, Kan Liu



Seismic acquisition is a procedure that studies geophysical layers or marine environments by measuring the reflections to one or more impulses (seismic excitation in general). The data obtained from a seismic gathering is typically three dimensional, with receiver index, shot index, and time (milliseconds) as the three axes. To increase efficiency, the interval between shots can be reduced. However, these intervals are sometimes reduced to an extent that the time between two shots is less than the time it takes for all reflections caused by a shot to dampen. This causes simultaneous sources, where one is the source of interest and the other is considered an interference. The objective of this study is to apply data processing algorithms to suppress unwanted sources from gatherings.

PHOTONIC SENSORS

Booth number: 103
Supervisor: Professor William Shieh
Group members: Chi Ren, Wuyu Song, Siyu Zhao

Many civil structures such as bridges, gas or water pipelines and water dams are indispensable to our modern society. As these structures are omnipresent, heavily used and relied upon for long periods of time, it is essential to ensure a high-level of safety. However, safety risks can occur through issues such as flooding or gas pipeline leakage. Monitoring the health of these structures is vitally important to our society.

This project aims to develop a distributed fibre optic monitoring system in a cost-effective manner. The proposed project includes the design, simulation and experimental verification of the proposed sensing system.

ENERGY HARVESTING IOT SENSORS FOR POWER ELECTRONICS

Booth number: 104
Supervisor: Professor William Shieh
Group members: Benjamyn Leith, Andrew Smith, Christopher Williamson

In medium-to-high power electrical systems, thermal cycling of conductors within busbars and switchboards can result in overheating, leading to reliability and safety issues. Typical temperature monitoring involves manually opening switchboards, which is time-consuming, expensive and physically dangerous.

Using the Internet of Things (IoT), our solution involves wireless sensors that can be mounted directly on to conductors inside the switchboard. These sensors use magnetic induction to harvest energy, increase longevity and report back to a central base station to enable continuous, cheap and safe monitoring. This project is sponsored by NHP Electrical Engineering Products.

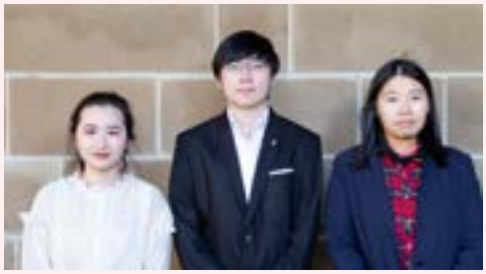
DESIGN OF CONTROLLERS FOR IRRIGATION CHANNELS USING A CONSTANT VOLUME APPROACH

Booth number: 105
Supervisor: Professor Erik Weyer
Group members: Yichao Dou, Feng Tian, Wei Li

Irrigation channel water levels are controlled by mechanical gates located along the channel. It is advantageous to control the downstream water level of a pool, which is the part of the channel between the two gates. In a constant volume control, a gate maintains the water level in the middle of the pool at its setpoint rather than at the downstream end. Along with the usual advantages that come with any downstream control strategy, the constant volume strategy allows the flexibility to exploit the storage in the pools to reject disturbances. This project was developed in conjunction with another team (Project Name: Tools to monitor performance and identity faults in a large network of automated interconnected systems, booth 106, see page 28).

TOOLS TO MONITOR PERFORMANCE AND IDENTIFY FAULTS IN A LARGE NETWORK OF AUTOMATED INTERCONNECTED SYSTEMS

Booth number: 106
Supervisor: Professor Erik Weyer
Group members: Yuchen Jing, Qixiao Li, Lin Lu



The objective of this project is to develop tools to monitor performance, identify faults (abrupt and degenerative) and identify their location in a large network of automated interconnected system. This project focuses on FlumeGate, an automated irrigation network developed by Rubicon Water that regulates flow at intermediate locations. The system consists of a number of components, including motors, gears, sensors, remote terminal unit (RTU) and a radio communication network. Faults in any of these components can have an impact on the level control performance. It is crucial to identify the faults and its location as it happens to minimise impact on performance or service delivery. This project was developed in conjunction with another team (Project Name: Design of controllers for irrigation channels using a constant volume approach, booth 105, see page 28).

BLOOD PRESSURE MONITORING SMART DEVICE DESIGN

Booth number: 107
Supervisor: Professor Elaine Wong
Group members: Tianyu Cui, Jie Gao, Xin Ji

Monitoring vital signs, such as blood pressure and heart rate can prevent many serious medical conditions. This project provides a smart non-invasive device for monitoring blood pressure, by measuring the pulse wave transit time (PWTT), which can continuously monitor patients remotely and digitally record medical data. It can be used in hospitals and by the general public. Compared to other devices, this device is smaller in size, cheaper and easier to use. This project is being sponsored by Capgemini Australia.

MANAGING A HEALTHY AND SAFE WORKPLACE

Booth number: 108
Supervisor: Professor Elaine Wong
Group members: Shuxian Huang, Jingyu Li, Shang Zhou

Research has shown that a healthy and safe workplace has a direct impact in increasing productivity. Fatigue is one of the main issues that can increase the risk of incidents and injuries in a workplace. The aim of this project is to better manage health and safety in such environments using a real-time monitoring solution comprising of a body sensor network connected to a software management hub. The data collected from the body sensor network will be wirelessly transmitted to the software management hub and evaluate the fatigue level of an employee using data analytics.

GOLF PRACTICE ANIMATION

Booth number: 109
Supervisor: Professor William Shieh
Group members: Zixi Chen, Qijing Yang, Tong Zhao

This project seeks to design a practice cage that can be set up in a backyard, enabling leisure golfers to practice in the convenience of their own home. The practice cage will monitor the golfer's shot and display results on devices such as smartphones. Recorded shot information includes swing speed, predicted trajectory, direction, and spin. This useful information can be used to improve a golfer's swing in real time and improve their skills.

MUR ELECTRIC MOTOR CONTROL

Booth number: 137
Supervisor: Associate Professor Peter Dower
Group members: Suya Bai, Lingbeibei Chen, Huaichong Huang

This project is responsible for designing a controller for the motor, which will optimise the vehicle dynamic performance of MUR's electric car. This involves modelling, system identification on a variety of test benches, Controller Area Network (CAN) communication and an advanced controller to implement slip control.

MUR ACCUMULATOR

Booth number: 138
Supervisor: Dr Gavin Buskes
Group members: Tien Ngo, Mimi Sun, Yida Wu

The project involves implementing a full sensor network on the electric vehicle to disable high voltage and high-power components of the vehicle in the event of crashing, emergency stopping or electrical faults. This involves nonprogrammable safety circuits and printed circuit board (PCB) design.

MUR SAFETY SYSTEMS AND DATA ACQUISITION

Booth number: 139
Supervisor: Associate professor Brian Krongold
Group members: Alvin Kurian Augustine, Sohaib Rasheed, Shiyu Zhang

The role of the Accumulator Team is to investigate appropriate cells to provide electric energy to the inverter, test them to determine their electrical characteristics and utilise a battery management system that will keep track of the battery status. This role also involves designing circuits that indicate the battery status, wiring and safety circuitry to minimise risk of fire and electrocution.

INFRASTRUCTURE ENGINEERING

Infrastructure engineering underpins the sustainability, design and efficiency of our cities. It includes four major disciplines: civil, structural, environmental and spatial engineering.

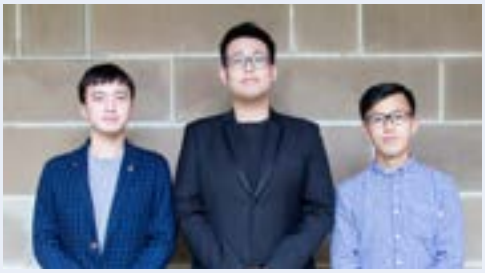
Civil and structural engineers plan and construct the infrastructure to manage increasing populations, finite resources and extreme events. While environmental engineers help improve the sustainability of our resources and design solutions to address climate change, bushfires and pollutions. And in a world where everything is geolocated, spatial information is at the heart of the Internet of Things, autonomous vehicles and how our cities work.

Discover infrastructure engineering of the future with our student projects in 3D scanning, geothermal energy, water and more.

CIVIL ENGINEERING

CONTRACT ADMINISTRATION SOFTWARE REVIEW FOR THE INFRASTRUCTURE AND CONSTRUCTION INDUSTRY

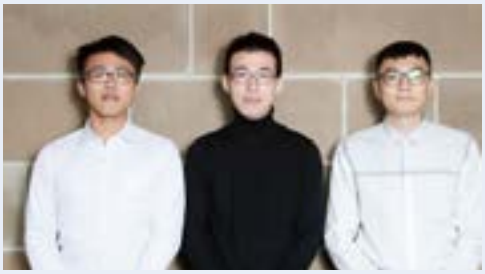
Booth Location: 19
Supervisor: Professor Colin Duffield
Group members: Qijun Han, Huashuai Sun, Zhongtao Wang



Managing complex infrastructure projects requires good contract administration. We studied the current industry practice from the view of a main contractor for contract administration and critically reviewed several types of market-available contract administration software, including their features and applications. During this process, we uncovered a gap between industry requirements and the latest contract administration software functions. Thus, by utilising the software Affinitext and the infrastructure project Western Roads Upgrade, delivered by WBHO Infrastructure, we generated insights and logic for the contract administration software selection for main contractors in the infrastructure and construction industry.

3D SCANNING THE UNIVERSITY OF MELBOURNE CAMPUS

Booth Location: 20
Supervisor: Professor Greg Foliente
Group members: Zirong Pan, Yizhao Peng, Yao Wu



Confronted with inefficient planning and asset management of building facilities, this project involves using the hand-held ZEB1 3D to capture 3D point clouds of the University of Melbourne's buildings and grounds. From the captured data, the team will contribute to refining the 3D campus model being developed at the Centre for Spatial Data Infrastructure and Land Administration (CSDILA).

The successful capture and conversion of 3D point clouds into 3D built environmental models of the campus will provide the foundational data framework for a new-generation asset management, energy and emissions management, disaster management and public safety operations at the University. This project will also provide an example to other campuses and multi-asset facilities around the country.

CIVIL ENGINEERING

PULL-OUT TEST SETUP FOR RETICULATED MICROPILES GROUP

Booth Location: 21
Supervisor: Dr Mahdi Miri Disfani
Group members: Kushal Chetri, Pai Liu

Growth in population, limited resources and increase in environmental concerns encourage researchers to find and develop new alternatives for traditional techniques in foundation engineering. One of these substitutions is a new concrete-free reticulated micropiles system developed recently in Victoria, which is known as Surefoot.

This project aims to develop a new test set-up and procedure for pull-out testing of Surefoot system, considering its difference with conventional micropile systems. The new system needs to be tested and verified in the field with support provided by Surefoot.

PERMEABLE PAVEMENT DESIGN INCORPORATING RECYCLED TYRE

Booth Location: 22
Supervisor: Dr Mahdi Miri Disfani
Group members: Yusuf Balkis, Yanhan Liu

Rapid urban development expands area of impervious road surfaces, contributing to an increasing storm water runoff problem across Australia. In order to introduce a more sustainable storm water treatment approach, this project presents an innovative permeable pavement design incorporating recycled tyre aggregate and crushed rock. Due to the nature of the porous structure, permeable pavement is found to be weak in mechanical performance. As a result, the project monitored and analysed the pavement field performance under traffic loadings to make a step forward to implement the design in Australia. This project is sponsored by Tyre Stewardship Australia, Merlin Site Services.

THERMAL RESPONSE TO ENERGY WALL

Booth Location: 23
Supervisor: Dr Guillermo Narsilio
Group members: Zhangshun Li, Yu Zhong

Geothermal energy is recognised as a clean, renewable and economic source that is generated and stored in the earth. One application of direct-use shallow geothermal energy is for space heating and heating by operating a Ground Source Heat Pumps (GSHP) system. One of the biggest challenges of this system is the high upfront capital cost associated with the drilling and trenching stage, which can be remarkably reduced by incorporating the system into geostructures such as retaining walls. A more comprehensive understanding on energy wall thermal performance is needed for optimal system design and construction. This project focuses on investigating and evaluating the thermal response to a thermo-active wall through field tests and numerical modelling. This project was developed in partnership with John Holland Group – Metro Early Works.

GEOTHERMAL PERFORMANCE OF ENERGY SCREW PILES IN SERIES

Booth Location: 24
Supervisor: Dr Guillermo Narsilio
Group members: Lawrence Hanson, Benjamin Robertson

Shallow geothermal energy systems use ground temperature as a renewable energy source for heating and cooling buildings. These systems operate by exchanging heat with the ground to provide heating in winter and cooling in summer. This project was based on an Australian-first geothermal energy system installed in Melbourne. This system uses steel energy screw piles connected in series, which provides both the structural foundation for the building and enables geothermal heat exchange for heating and cooling. Working with GeoExchange Australia, this project installed sensors and conducted field tests on these piles to evaluate their performance. Computer modelling was also used to provide an overall assessment of how this new system performs in the Australian context.

CIVIL ENGINEERING

3D PRINTING AND MECHANICAL PROPERTIES OF LIME HEMP CONCRETE TO MAKE SUSTAINABLE WALL PANELS

Booth Location: 25
Supervisor: Dr David Wilson
Group members: Rajiv Kumar Gupta, Youzhi Shen

Hempcrete is a natural building material, which is primarily composed of hemp shiv, lime binder, and water. Additive Manufacturing (AM) is an automotive process in the manufacturing industry using advanced technology. The results show the density of the hempcrete samples varies from 628 to 782 kg/m3. The compressive strength of the hempcrete specimen containing Cammiphora Mukul has the higher strength (up to 0.66 MPa) than the plain hempcrete specimen (0.27 MPa).

ENVIRONMENTAL ENGINEERING

MODELLING THE VARIABILITY OF CATCHMENT WATER QUALITY

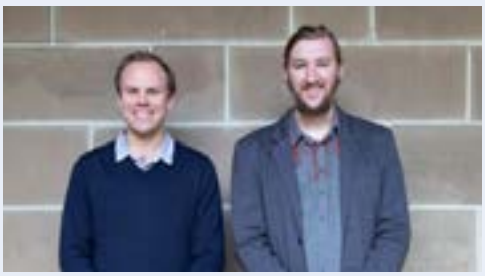
Booth Location: 26
Supervisor: Professor Andrew Western
Group members: Shuangying Deng, Dhananjay Singh, Yuhan Zhou

Understanding the variability of catchment water quality is useful for operational catchment management. Using long-term data monitoring collected from multiple catchments, a statistical model has been successfully developed to link the time-averaged water pollutant concentrations in streams with catchment characteristics. This project aims to extend this model to describe the full distributions of pollutant concentrations at these catchments. The extended model aims to inform the expected water quality conditions at different locations, which can be directly compared with relevant environmental guidelines to ensure compliance, as well as identifying locations with higher risks of experiencing water quality issues.

SPATIAL ENGINEERING

SBAS TESTING FOR CIVIL AVIATION

Booth Location: 27
Supervisor: Simon Fuller
Group members: Christopher Lambert, Christopher Marshall



This project involves testing the accuracy and integrity of satellite positioning using the new Satellite-Based Augmentation Service (SBAS). This service is the first in the world to provide positioning corrections and improved availability over multiple Global Navigation Satellite Systems (GNSS) bands. Analysis is conducted on data from two static receivers and a kinematic receiver in a small plane with flight paths throughout Australia. The outcome will show the difference in accuracy, integrity and signal quality compared to other positioning techniques, along with aviation metrics such as protection levels.

MECHANICAL ENGINEERING

From aerospace to robotics, mechanical engineers design machines to improve efficiencies in the world around us, and beyond. Robots, energy systems and manufacturing equipment – practically anything with a moving part is made by a mechanical engineer.

At Endeavour, you'll find mechanical engineering projects focusing on drones, satellites, 3D printing and scanning. You'll also encounter the MUR Motorsports racecar as well as collaborations with biomedical engineering.

DE-ORBITING SMALL SATELLITES FOR NATURAL DISASTER RESPONSE (DESSNDR)

Booth number: 66
Supervisor: Dr Airlie Chapman
Group members: Devon Arganaraz, Kapil Kumar, Byung yeon Mun

CubeSats are small, standardised satellites, as small as 10cm x 10cm x 10cm or 1U. They can be easily made with cheaper components, making space missions more accessible for smaller organisations. While launch options are well-understood, their end-of-life options are unexplored and require a de-orbiting solution. Our project aims to model, conduct a feasibility study, and map out uncertainties regarding de-orbiting options for CubeSats. The aim of this project is to achieve first response for restoration of communications in natural disaster affected areas by the delivery of a communications device. We would like to thank our sponsor STELaRLab of Lockheed Martin.

RURAL HYDRO-ELECTRIC POWER GENERATION

Booth number: 67
Supervisor: Dr Robert Gordon
Group members: Thilak Manohar, Siddarth Sundaram, Vincent Wong

1.06 billion people around the world, or roughly 14% of the global population, do not have continuous access to electricity. The majority of these regions are within Africa and are spread throughout developing Asia. This project is centred on the design of a small-scale, low-cost, run-of-river hydro-kinetic device that will aim to meet the basic power requirements of a small community within these regions.

UNDERWATER 3D SCANNER

Booth number: 68

Supervisor: Professor Nicholas Hutchins

Group members: Akshay Kumar, Shivang Khandelwal, Martin Lee, Vishwesh Sridhar

Biofouling, the build-up of marine organisms, increases drag on a ship's hull and has been estimated to increase fuel usage by up to 80%. Hull cleaning typically requires dry docking the ship, which is both expensive and time-consuming. Presently, the extent of biofouling can only be crudely estimated. This makes it impossible to know when a ship should be cleaned, leading to increased pollution and operating costs. Continuing from previous work, this underwater 3D scanner is a low-cost, highly accurate, 3D image-based underwater device. It has been designed to be used by a diver while the ship is at sea. The elegant and simple design will allow for use across a broad range of industries where visual inspections are required.

DESIGN AND OPTIMISATION OF THE MICRO-STRUCTURE OF A POROUS BONE IMPLANT

Booth number: 69

Supervisor: Gabriele Imbalzano

Group members: Jing Lin, Yuan Ma, Chenxi Peng, Harsh Tarkar

Titanium (Ti) is widely used for orthopaedic implants since it is biocompatible and hypoallergenic. However, the unmatched stiffness of an implant with surrounding bone tissues causes stress shielding can result in complications such as bone resorption, implant loosening or dislocation, and eventually implant failure. One possible approach to mitigate this is the use of 3D printing to create fully-porous implants with bone-matching stiffness. This research investigates various 3D porous microstructure designs and compares their mechanical properties. Parametric studies produce a database of favourable designs, where the relationships between design parameters and mechanical properties are analysed.

This project was developed in conjunction with another team (Project Name: Design and optimisation of the macro-structure of an osseointegration femur implant, booth 70, see page 36) and is supported by the University of Melbourne.

DESIGN AND OPTIMISATION OF THE MACRO-STRUCTURE OF AN OSSEOINTEGRATION FEMUR IMPLANT

Booth number: 70

Supervisor: Professor Peter Lee

Group members: Saatwick Mathur, Jiaqi Shi, Ti Wu

The overall aim of this project is to design a femur implant which could be attached to the bone through the osseointegration technique. The implant shape and material should minimise the amount of stress shielding and reduce bone resorption rate without compromising the strength of bone-implant assembly.

This project was developed in conjunction with another team (Project Name: Design and optimisation of the micro-structure of a porous bone implant, booth 69, see page 36).

INVESTIGATION OF MODELS FOR SOLID SOLUTION STRENGTHENING

Booth number: 71

Supervisor: Professor Graham Schaffer

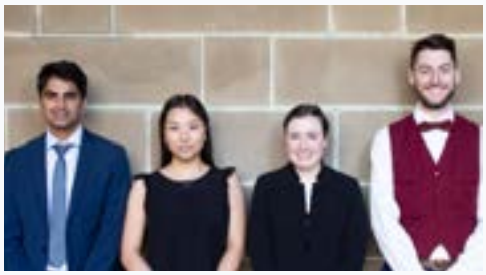
Group members: Youssef Ahmed Abdelmohsen Aly Abouelseoud, Cameron Wilson

In some alloys where there is no big difference in size and/or rigidity between the base and solute atoms, significant strengthening is still observed. A good example of this is strengthening in austenitic stainless steels. The difference in size as well as rigidity between the base element, iron in austenitic steels, and solute atoms is not big enough to explain the solution strengthening observed in the alloy.

This shows that the existing models have limitations in terms of modelling the correct strengthening in austenitic stainless-steel alloys. It has been reported in the literature that apart from the size and rigidity factors, the change in stacking fault energy has its own effect on the strengthening of alloys like stainless steel.

A PROTOTYPE FOR 3D PRINTING CONCRETE

Booth number: 72
Supervisor: Dr Ali Kashani
Group members: Benjamin Appuhamy, Jacky Li, Eleanor Lourey, Alasdair O'Brien



3D printing with concrete has the potential to revolutionise the building and construction industries by improving the precision and detail in concrete structures and reducing the need for human labour. Our design is a prototype for a 3D printer to print small, bespoke concrete parts. The continuous pumping of the nozzle ensures that concrete is pumped precisely and that printed structures are prevented from slumping. This nozzle could be adapted for use on a gantry to cater to large-scale building projects.

SOFT METAMATERIALS FOR ENHANCED PERSONAL PROTECTION

Booth number: 73
Supervisor: Gabriele Imbalzano
Group members: Andrew Bates, Alexander Cutri, Nicholas Jolly

This project is investigating soft auxetic materials (that exhibit a negative Poisson's ratio) and their use in personal protective equipment, such as bike helmets or knee pads. The unique shape of the auxetic structures can present some interesting mechanical properties, which allows for improved protective systems.

Additive manufacturing enables the creation complex geometries that would not be possible with any other manufacturing methods.

DEVELOPMENT OF NUMERICAL METHODS TO EVALUATE DEFECTS IN ADDITIVE MANUFACTURING

Booth number: 88
Supervisor: Professor Peter Lee
Group members: Junjiang Liu, Moye Ma, Jian Xing

The main focus of this project is to identify the geometrical problems related to additive manufacturing of complex lattice structures and to improve the printing quality by analysing and making numerical models from the additive manufactured lattice structures.

Lattice structures are currently one of the most used applications of additive manufacturing. They are very flexible, can accommodate to very complicated shapes and have mechanical properties such as light weight and high stiffness. They are mostly used in aerospace, biomedical applications. This project develops numerical models for the additive manufactured lattice structures, to help designers to better understand the defects of additive manufacturing and their effects.

SEA-ICE-WIND-WAVE-INTERACTION (SIWWI)

Booth number: 89
Supervisor: Professor Jason Monty
Group members: Thomas Carman, Donghua Lu, Dylan Jessop, Han Wei Low

This project involves the study of sea ice and its interaction with waves, using the Michell Hydrodynamics Laboratory at the University of Melbourne. This project will collect ice drift data via Vicon motion capture cameras, which will then be used to model the drift of ice floes in Antarctica to gain deeper understanding of this phenomenon and its potential environmental impacts.

AUTONOMOUS UNDERWATER VEHICLE

Booth number: 90
Supervisor: Professor Jason Monty
Group members: Tom Beischer, Piers Clinton

This project aims to design improvements on a previously-built submarine, which is shaped like a torpedo and is approximately 1m in length. It also aims to program the submarine enabling it to move autonomously and collect depth, temperature and pressure measurements in open water.

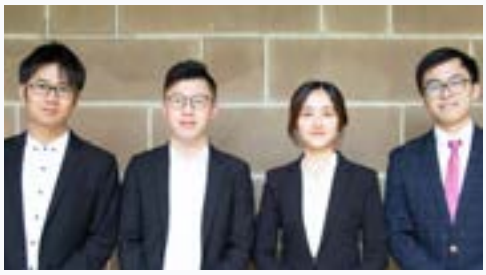
MODEL AIRCRAFT DESIGN, BUILD AND FLIGHT

Booth number: 91
Supervisor: Professor Jason Monty
Group members: Yunlong Hu, Ying Li, Yonglei Zhang

Our project aims to showcase advances in mechanical engineering by designing, fabricating and demonstrating the flight capabilities of an aircraft model. The design will balance flight handling qualities with practical and affordable manufacturing requirements to ensure high vehicle performance. This unmanned, electric-powered and radio-controlled aircraft will be created using laser cutting and 3D printing.

OPTIMISING BLOOD FLOW IN STENTED HUMAN ARTERIES: A COMPUTATIONAL FLUID MECHANICS APPROACH

Booth number: 92
Supervisor: Professor Andrew Ooi
Group members: Hanliang Li, Xinpei Li, Wei Qiang, Chengqian Zhu



Atherosclerosis is a major risk factor in many cardiovascular diseases and the single greatest killer in the western world. It is caused by the formation of localised plaque containing cholesterol and other lipids beneath the intima of arterial wall, leading to blood flow occlusion. The overall aim of this project is to take advantage of a new intracoronary imaging method to develop experimental and computer models of coronary blood flow to examine the influence of stent devices on the dynamics of blood flow. Fundamental research in fluid mechanics and the post-processing of medical images will lead to the provision of necessary technologies for rapid analysis and customised therapeutic strategies that ensure long-term enhancement of blood flow characteristics in arteries.

EXPERIMENTAL GENERATION OF DIFFERENT WIND-PROFILES FOR LABORATORY AND AS/NZS TERRAIN CATEGORIES

Booth number: 93
Supervisor: Dr Jimmy Philip
Group members: Khang-Yuan Liew, Jie Xiang, Ke Zheng

The project revolves around generation of different wind-profiles for laboratory and Australian and New Zealand (AS/NZS) terrain categories (TCs) in a wind tunnel. The former focuses on generating the laminar, transitional and turbulent boundary layers to study the transition of the flow, for which a smooth elliptical leading edge was fabricated. The latter focuses on reproducing wind profiles for different TCs based on AS/NZS standards, by using different configurations of tripping devices including spires, artificial grass and rods. The reproduced TCs can be used for studies on how new structures would further affect the wind, that could assist in construction and development.

UNRAVELLING THE DYNAMICS OF UNSTABLE AIRFLOW OVER GROUPS OF SLENDER STRUCTURES

Booth number: 94
Supervisor: Dr Jimmy Philip
Group members: Joel Mangalasinghe

Forests, crop fields, wind farms and skylines are all examples of slender structures, which can, in most cases, be approximated as canopies. Most familiarly, the swaying of forest canopies in the wind presents the question of how such oscillations occur and if they present a threat to engineering structures. Research suggests that the driving force behind this swaying motion is largely independent to the stiffness of the canopy structures and is instead due to instabilities that form in the fluid over the canopy. Deciphering the dynamics of the fluid instabilities can open up many possibilities for engineers to design structures against oscillating wind loads or even harness such oscillations in nature for energy generation applications. This self-initiated project focuses on the development of the theory behind these fluid instabilities using advanced mathematical and computational techniques and a possible experimental verification using advanced signals analysis methods.

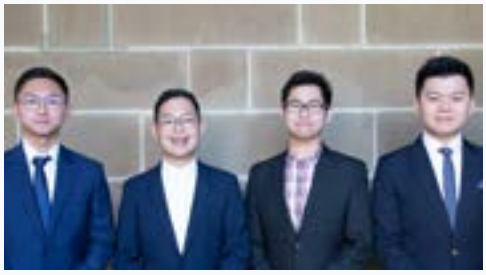
PERMEABILITY MEASUREMENTS OF POROUS MATERIALS

Booth number: 95
Supervisor: Dr Jimmy Philip
Group members: Papangkorn Jessadatavornwong, Martin Li Aun Khoo

An experimental setup was designed and constructed to measure the pressure difference across a porous material sample that was provided. The pressure difference will then be used to calculate the permeability of the sample. Permeability is characterised by the flow diffusivity through the scaffold structure. Permeability is important in biomedical engineering applications in particularly for bone scaffolding technique. This scaffolding technique is important to introduce porosity to the structure to assist with tissue self-regeneration.

DESIGN AND BUILD OF LOW-NOISE LARGE ASPECT RATIO NOZZLES

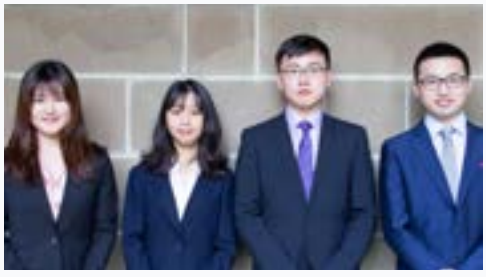
Booth number: 96
Supervisor: Professor Richard Sandberg
Group members: Roberto Djonnatha, Jeremy Lau Wun Ching, Lim Jia Cherng, Ong Tien Lun



Designers often face situations where they must find a compromise between various trade-offs regarding a product's performance. The Dyson Airblade V has an outstanding power density but generates a wide spectrum of undesired noises. Previous studies have shown that serrations can reduce generated noises. This project focuses on finding the potential of serration attachments in reducing the noise generated by a Dyson Airblade V. Dyson has sponsored this project with a Dyson Airblade V.

DESIGN AND BUILD OF CASCADE WIND TUNNEL FOR MEASURING WAKE PROFILES

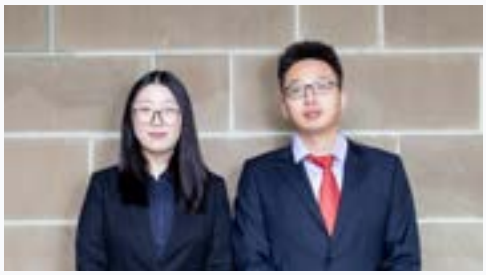
Booth number: 97
Supervisor: Professor Richard Sandberg
Group members: Ya Gong, Bing Leng, Shu Wang, Junyan Yang



Increasing compressor performance is critical in applications, from hair dryers to aircraft engines. Performance and high efficiency depends on minimising aerodynamics losses, which can basically be inferred through the wake profile measured downstream of the trailing edge of compressor blade. The objective of this project is to design and build a linear cascade wind tunnel for wake profile measurement, under operating conditions specified by industry partner Dyson. During operation, flow is accelerated through a contraction and turned by several blades with constant pitchwise spacing. Simulation and various manufacturing techniques are both applied in this study.

ASSESSING NOVEL MACHINE-LEARNT MODELLING TECHNIQUES FOR RACE CAR AERODYNAMICS

Booth number: 98
Supervisor: Professor Richard Sandberg
Group members: Junpeng Ren, Yue Shi



In this project, new RANS models developed at the University of Melbourne using novel machine-learning techniques are tested on geometries of relevance to race car aerodynamics to assess their performance, in particular, the ability of the new closures to accurately predict vortex interaction with wheels. The quality of these simulations is investigated by comparing new models with the SST model and LES model. This project was developed with McLaren Racing.

LOW NOISE ROTOR

Booth number: 99
Supervisor: Professor Richard Sandberg
Group members: Zhaoxi Jiang, Tianyi Li, Ruilai Zhang

Reducing the noise of Micro-Air Vehicles (MAVs) is essential for both discretion of military operations and limiting noise pollution during civilian use. This project will design rotors for MAVs using 3D printing. It will then measure the sound they create in a special room using cardboard and foam.

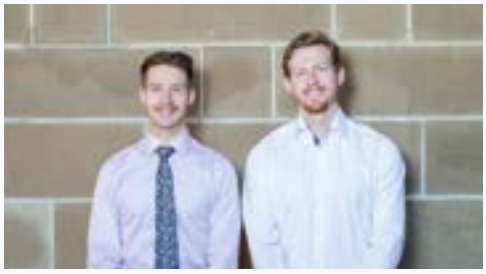
CFD OPTIMISATION OF A RACEWAY POND GEOMETRY, FOR USE IN A MICRO-ALGAE PRODUCTION SYSTEM

Booth number: 110
Supervisor: Professor Richard Sandberg
Group members: Xin Ning, Teng Sun, Xiaodong Xing, Rongchen Zhu

This project aims to optimise raceway pond geometry, which is used in microalgae production by MBD Energy. The team will run simulations to determine the production rate of microalgae using computational fluid dynamics (CFD) methods and software such as OpenFOAM and Gmsh. It will also examine how the geometry of the pond can be optimised to find the most economic and efficient shape.

IMPROVING THE FUNCTIONALITY OF 3D PRINTED PROSTHETIC HANDS

Booth number: 111
Supervisor: Dr Rina Shvartsman
Group members: Matt Collinson, Michael Naughtin



Prosthetic hands can be very costly and not always accessible for those who need them most. This applies especially to children who grow out of their prosthetic every eight months and have to keep purchasing new ones. 3D printing has enabled the development of functional and cheap prosthetic hands. This project, developed with charity RoboHand Australia, focuses on researching current prosthetic designs and developing improvements to be used in future prosthetics.

LOAD-SENSE PUMP TRAINING RIG

Booth number: 112
Supervisor: Dr Mohsen Talei
Group members: Vishal Anand Shinde

A load-sense pump 'senses' the load on the hydraulic circuit and accordingly adjusts its output flow rate to this need. The main purpose of these pumps is to minimise energy losses, and in a world where sustainable practices and money saving is valued, they are of big importance in the fluid power industry. The working principle is simple, yet many engineers struggle to grasp the concept. Understanding load-sense is integral to being a successful hydraulic engineer, and in partnership with the HYDAC Training Centre from HYDAC Pty. Ltd., a load-sense pump training rig was designed to be built for integration into their future hydraulic pump training courses.
The main aim of the project is to give a visual understanding of how a load-sense pump works and how the different parts of the load-sense circuit work together in a system.

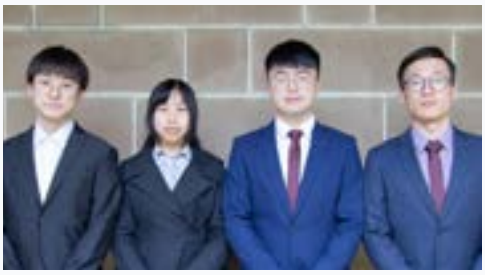
ARTIFICIAL INTELLIGENCE-DRIVEN CONDITION MONITORING AND PREDICTION IN MINING EQUIPMENT

Booth number: 113
Supervisor: Dr Mohsen Talei
Group members: Lyle Talbot

This project aims to build an artificial intelligence (AI)-driven conditional monitoring systems for large mechanical equipment in an ore refining process. An 'edge node' has been developed and deployed comprising of a sensor array and data logging system. The aim is firstly to build a high-quality labelled data-set that comprehensively captures the range of operational states experienced by mechanical equipment over one month. Following this, a model that can detect transition in operational states will be built, which will help investigate the potential to forecast transitions and failures occurring in the near future. This project has been developed in partnership with Singulariti Systems Pty Ltd.

SIMULATING TEMPERATURE AND STRESS DISTRIBUTIONS IN ADDITIVE MANUFACTURING

Booth number: 114
Supervisor: Professor Kenong Xia
Group members: Haoyu Li, Long Ouyang, Shanmin Wang, Zhao Wang



Additive manufacturing (AM) is revolutionising the manufacturing industries worldwide, enabling complicated shapes and individualised designs. There are many challenges for achieving high-quality objects, such as high temperature or residual stresses induced by cyclic heating and high cooling and heating rates during AM, both of which are critical since they significantly influence microstructure and properties. This project aims to computationally investigate temperature and stress distributions in Ti-6Al-4V, a widely used titanium alloy, under different AM parameters, and to correlate the calculated data with the corresponding experimental data produced under the same conditions.

DESIGN FOR ADDITIVE MANUFACTURING OF UNMANNED AERIAL VEHICLES

Booth number: 115
Supervisor: Professor Kenong Xia
Group members: Saee M Alve, Edwin Torres, Jiao Zhang, Xingbo Zhang

This project aims to enhance the aerodynamics of military-grade unmanned aerial vehicles (UAVs). Focusing on flight parameters such as flight endurance, range and speed, this project will optimise wing design and incorporate shape memory alloys. To achieve this, the team will use the resources in the University of Melbourne's Functional Materials Lab, including the Reinshaw AM50 Additive Manufacturing System.

MUR COORDINATION

Booth number: 131
Supervisor: Associate Professor Yi Yang
Group members: Fraser Nicol, Philip Yap

The Coordination team executes top-level strategy by setting the direction of MUR and defining the structure and roles within the team to realise this direction. The team manages team functions as well as the vehicles that they build, including both the combustion and electrical vehicles. The role encompasses managing sponsorships, budget, supply chain activities, recruitment, the junior program, external relations, marketing and events.

MUR INTEGRATION

Booth number: 132
Supervisor: Yi Yang
Group members: Ryan Carter, Sai Fairchild, Ambar Srivastava, Tony Zhang

The Integration team oversees the design, manufacture and validation of both the electric and combustion MUR vehicles. The team ensures compliance with competition rules and sets top-level goals for both vehicles. The Integration team is responsible for ensuring that at the end of the year, both cars are well-tested, fully-compliant and that the drivers are ready to perform their best at the annual FSAE competition.

MUR ENGINE

Booth number: 133
Supervisor: Associate Professor Yi Yang
Group members: Vladimir Borzykh, Andrew Gunawan, Gary Li, Xin Lu

The Engine team is responsible for implementing a high-performance engine system for the MUR combustion vehicle. This includes modifying, validating and dyno tuning an existing engine, as well as the design, manufacture and validation of auxiliary components. These auxiliary components include the fuel system, exhaust, intake and lubrication. Software packages for CAD and engine simulation are used as well as manufacturing techniques such as 3D printing, laser cutting, welding and CNC machining.

MUR BRAKES AND DRIVETRAIN

Booth number: 134
Supervisor: Dr Robert Gordon
Group members: Aakash Babu Suresh Babu, Sharun Parakattel Benny, Vincent Marciano, Brendan Trinh

The MUR Brakes and Drivetrain team is responsible for developing and implementing a drivetrain that can efficiently transmit power from the engine to the wheels while balancing performance needs. The team is also responsible for developing a pedal box suitable for a race performance driver and a controlled braking system that effectively decelerates. These devices will be applied on both MUR's combustion and electric vehicles.

MUR SUSPENSION

Booth number: 135
Supervisor: Dr Simon Illingworth
Group members: Will Ellett, Jarod Haegel

Every force that a race car exerts, whether it is accelerating, braking or cornering, is transmitted through the four contact patches between the tyres and the track surface. Through careful geometric design and vibrational analysis, MUR's Suspension team aims to keep the tyres in optimal conditions by achieving best handling and dynamic performance, without compromising vehicle aerodynamics.

MUR CHASSIS CARBON-FIBRE COMPOSITE MANUFACTURE

Booth number: 136
Supervisor: Dr Mohsen Talei
Group members: Michael Kurnato, Jaideep Singh

The Chassis Carbon-fibre Composite Manufacture team is responsible for the design and validation of rigid carbon panels for the combustion and electrical MUR vehicles. As the properties of the carbon panels are highly dependent on the manufacturing process, this project focuses on optimising manufacturing to produce strong and stiff floor panels, firewalls and closeout panels.

MUR COOLING

Booth number: 140
Supervisor: Dr Mohsen Talei
Group members: Kelechi Okoro, Andrew Seddon

The responsibility of MUR's Cooling team is to design, manufacture, assemble and test all components of the electric thermal management system. This includes testing cooling in the following major components: two electric motors, two inverters and the accumulator.

MECHATRONICS ENGINEERING

With mechatronics, you can control the robots and hold the key to a smart and connected future. Mechatronics engineers blend mechanical, electrical and software engineering to create computer-controlled systems and automated equipment to optimise the world around us.

Our students' mechatronics projects focus on drones, automation, robotics, biomechanics and more.

AUTONOMOUS AERIAL DEPLOYMENT OF A SENSOR NETWORK FOR DISASTER RELIEF

Booth number: 116
Supervisor: Dr Airlie Chapman
Group members: Declan Burke, Beau Colley-Allerton, Cameron McNeil, John Reading

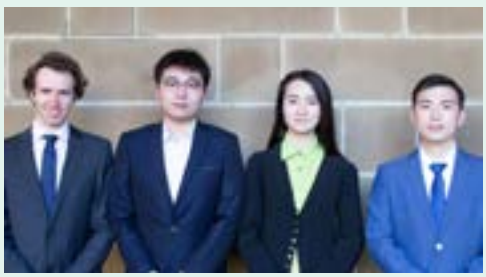
This project looks to realise the synergy between static, low-powered sensors and dynamic aerial platforms by prototyping a beacon deployment mechanism for a generic quadcopter. The attachment enables a medium-sized quadcopter to rapidly and repeatedly distribute sensors over large areas.

The beacons' sensor packages and the deployment algorithms are designed specifically for establishing a first-response, wireless network in a disaster area, but the platform developed has far reaching IoT applications.

This project is sponsored by The Defence Science and Technology (DST) Group.

AUTONOMOUS VEHICLE FLEET POSITIONING: COVERAGE ASSURANCES UNDER FAILURES AND PERTURBATIONS

Booth number: 117
Supervisor: Dr Airlie Chapman
Group members: Yun Fang, Christopher Harrison, Shuo Liu, Zhaoxi Yi



Distribution sensing problems can arise when multiple sensors are placed in an area and cooperatively survey the environment. For example, sensor failures can leave blackout areas where coverage is poor. An alternative is to equip sensors to mobile platforms such as a fleet of autonomous vehicles. The problem of continual coverage of an area then becomes a fleet positioning problem. If failures in the fleet occur then it is desired that the vehicle fleet adapts, transitioning from its initial planned position to a new more performant one. This involves designing a coverage algorithm, implementing and testing the algorithm on a fleet of ground vehicles and exploring performance assurances accounting for individual vehicle failures, vehicle motion characteristics and environmental perturbations.
This project is sponsored by QinetiQ.

VISUALISATION OF TURBULENT FLOWS

Booth number: 118
Supervisor: Dr Daniel Chung
Group members: Robert Smith

Visualising fluid simulations is an interesting and challenging part of fluids research. As simulations increase in complexity, finding intuitive visualisations that aid communication is crucial. This project uses Python and Blender to develop an automated pipeline to explore volume visualisations. A wide variety of configurations are available to produce many different visualisations of the data. The project has demonstrated visualisations with pressure, temperature and flow velocity components for turbulent flows.

DESIGN AND MANUFACTURE OF A FLOW-RESPIRATION CHAMBER

Booth number: 119
Supervisor: Associate Professor Robert Day
Group members: Ashveer Singh Malhotra, Zhanlin Zhang

This project aims to design and manufacture a respiration chamber for abalone. It recreates the varying ocean flows and measures respiration for different flow over the abalone. In addition, the impact of slow temperature changes on abalone respiration is also investigated.

SEGWAY-LIKE ROBOT FOR WORKSHOP

Booth number: 120
Supervisor: Dr Simon Illingworth
Group members: Yuichiro Hirose, England Kwok

The Segway-like robot aims to provide a framework for a control systems workshop and to demonstrate the possible functionalities that can be implemented using differing levels of control theory. Modelled as a mobile inverted pendulum, we have designed automated controllers to tackle the balancing and movement control problems. We also have prepared a software template which we used to implement these controllers and to promote the educational aspect of our Segway-like robot.

BEAM RIDER CONTROL FOR DRONES

Booth number: 121
Supervisor: Professor Chris Manzie
Group members: Stephanie Burns, Yuan Lin, Jarryd Rogers

This project uses beam-rider and laser encoding technology to show how flight control for drones can be automated using simple laser pointers. This project has been developed with the supervision and assistance of Lockheed Martin STELaR Lab.

INTERFACE DEVELOPMENT FOR MACHINE LEARNING OF AUTOMOTIVE CALIBRATION PRIORITIES

Booth number: 122

Supervisor: Professor Chris Manzie

Group members: Marco Liu, Minhan Yan, Zongyang Yu

Engine control is a multiple-input multiple-output problem, and requires a heavy calibration burden to meet production requirements. This is exacerbated when using modern control techniques such as model predictive control, as the number of calibration options grows significantly. In this project, as part of a collaboration with Toyota Motor Company (Japan), we have developed an interface in MATLAB GUI to present a number of transient drive cycle trajectories and highlight areas where the performance is unsatisfactory. Using the data, clustering and active learning techniques are investigated to optimise the controller and automatically select new linearisation points.

SOLAR GENERATION, ENERGY STORAGE, AND BATTERY DEGRADATION

Booth number: 123

Supervisor: Dr Guillermo Narsilio

Group members: Ying Ying Beh, Shyam Sundar Shiv Kumar, David William Ripper, Hou Nam U

The popularity of energy storage systems is likely to increase in the near future. There is capacity to increase their return value by improving their operational strategy. The purpose of this project is to develop a controller that implements different operational strategies and study their effects on lithium polymer cells. It is hoped that the findings of this project contribute to the development of the renewable energy technology. This project is supervised by industry partner IBM.

TACTILE-CAPABLE ROBOTIC HAND DESIGN AND DEVELOPMENT

Booth number: 124

Supervisor: Associate Professor Denny Oetomo

Group members: Zhijie Chen, Yangmengfei Xu

The objective of this project is to develop a tactile sensor system that provides the information about contact force to fit on a robotic hand's fingertip. A permanent magnet is rigidly attached inside the robotic hand fingertip where the external force is acted. To find out this external force information (such as magnitude, direction and location), the displacement and rotation of the magnet due to the rubber deformation can be obtained through a magnetic mathematical model and finally converted to the corresponding force information through another material deformation model.

SURGICAL ROBOT UTILISING LOCAL MAGNETIC ACTUATION

Booth number: 125

Supervisor: Associate Professor Denny Oetomo

Group members: David Marcuson, Rhys Musgrave-Evans, Yudi Ren, Tianhao Wang

This project involves the design and development of a small, low-cost, serial manipulator for use in minimally invasive laparoscopic ('keyhole') surgery as a robotic alternative to manual surgical graspers. The design uses local magnetic actuation (LMA) as a means of driving the internal rotors from outside the body, removing the need for wiring to the internal device. Specially designed pulleys mitigate the impact of slack and allow for cable-driven control of each degree of freedom, including the gripping action. The grasper's jaws and teeth have been designed to minimise tissue trauma and the cable path is positioned in such a way to mechanically reduce the impact of joint coupling to almost zero.

COMPLIANT ELBOW PROSTHESIS

Booth number: 126

Supervisor: Associate Professor Denny Oetomo

Group members: Fernando Gunawan, Kang Tai, Mun Hoe Wang, Wei Feng Yang

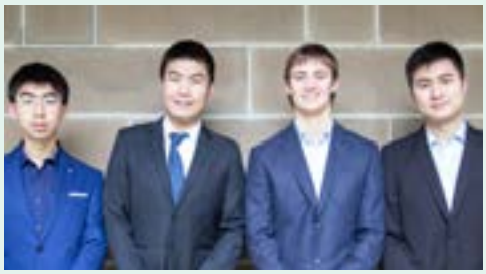
New prosthesis control algorithms enables the coordinated motion of the prosthetic limb with the user's residual limb. However, coordinated motions introduces new challenges to current prosthetic devices. One of these challenges is safety, as the device is now more likely to accidentally collide with its surroundings because users are no longer directly controlling the joint of the prosthesis limb during coordinated movements. The compliant elbow prosthesis aims to minimise safety risk and prevent accidental collision. This project was developed with support of St Vincent's Hospital.

BONI: PROSTHETIC FEEDBACK VIA BONE CONDUCTION

Booth number: 127

Supervisor: Associate Professor Denny Oetomo

Group members: Dongqi An, Joshua Guthrie, Justyn Lim, Yi Rong



This project aims to test the benefits of bone conduction for upper limb feedback control, while also testing the effectiveness of 3D scanning and printing prosthetic sockets in comparison to the traditional mould process. Current technology surrounding bone conduction only relies on stimulation of the amputee's abutment. However, since research has shown that non-invasive technology is preferred to invasive, this project looks to explore the use of non-invasive bone conduction and test its effectiveness as a feedback measure.

BIOMECHANICS OF RACEHORSES AND DETECTING LIMB LAMENESS

Booth number: 128

Supervisor: Dr Elyse Passmore

Group members: Parisa Afshar, Raja Rajeswari Ramkumar, Vu Xuan Le

This project aims to combine mathematics, analytical analysis and algorithms to detect true lameness in racehorses and quantitatively discuss the degree of lameness. This is carried out by using kinematics, ground reaction forces and pressure data collected from racehorses from the U-Vet Werribee Equine Centre's 3D motion capture system.

This project will also develop user interface software to enhance ease of use and enable real-time applications. This software will be useful for practitioners who are involved in analysing lameness in racehorses at the U-Vet Werribee Equine Centre.

ROWING SENSOR SYSTEM

Booth number: 129

Supervisor: Dr Rina Shvartsman

Group members: Lachlan Wright

The aim of this project is to measure the velocity of a rowing boat relative to the water it is moving through with the greatest accuracy possible and to conveniently present this information in real time to athletes and coaches for performance feedback. This project includes the development of a complete system to measure a boat's velocity relative to water incorporating high quality user interfaces, wireless communication and information displays.

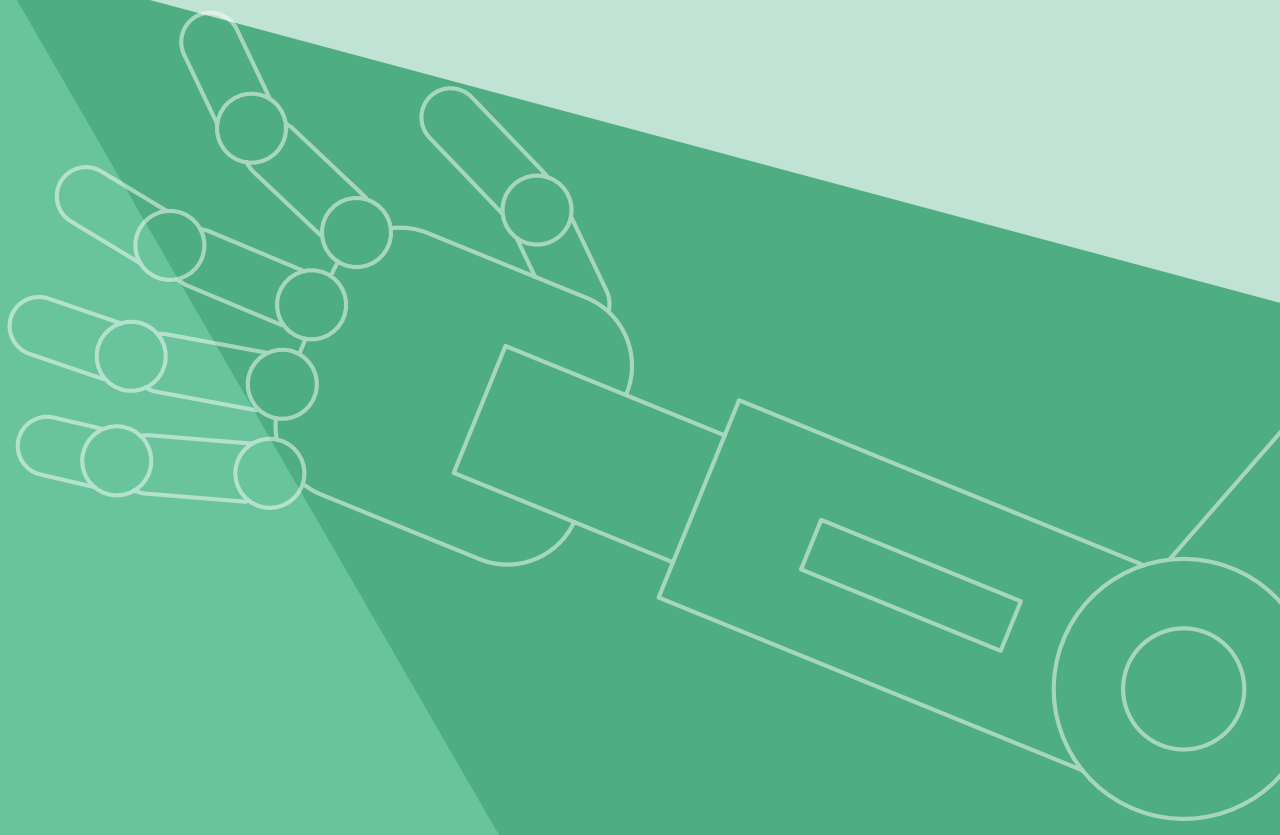
DESIGN OF A PORTABLE MOBILE PHONE CHARGING STATION FOR MASS DISPLACEMENT IN THE PACIFIC

Booth number: 130

Supervisor: Dr Rina Shvartsman

Group members: Yogesh Cunniputhur Kumaravel, Arun Cherian Mathew, Ram Charan Teja Thota

This project aims to develop a mobile charging station to use in disaster zones in Asia-Pacific regions. The need for a portable charger is required for refugee camps where there are power shortages. The portable charger is designed to help supply power for charging devices such as cell mobile phones in emergencies. This project is developed in the interest of Engineers Without Borders Australia.



COMPUTING AND INFORMATION SYSTEMS

Computing and information systems is transforming the future of business, health and entertainment. With rapid developments in programming, AI and cloud computing, software systems are the building blocks behind niche mobile apps and large enterprise systems.

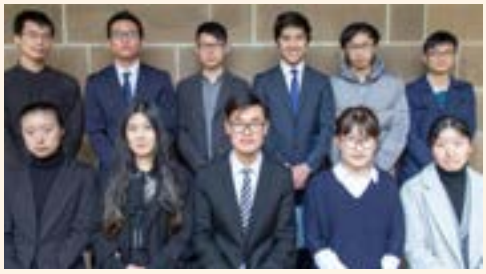
Discover the future of computing and information systems at Endeavour, including apps to inform patients, predict bushfires, streamline contractor management and assist those experiencing homelessness.

MEDICAL SECRETARY

Booth Location: 10

Supervisor: Dr Eduardo Araujo Oliveira

Group members: Yueyan Chen, Alston Chu, Xudong Fan, Jiacong Ling, Yuanchenxi Liu, Wenzhuo Mi, Tong Niu, William Pan, Ruoyi Wang, Chuan Yang, Zhun Yang



Medical Secretary is a cross-platform mobile application targeted at patients with serious illnesses, such as cancer. This application helps patients organise and manage information and appointments surrounding their diagnosis, which in turn, will help reduce confusion and queries.

The application is to be used in tandem with the existing medical database software GENIE, which is used in approximately 4,000 clinics in Australia. Together, these applications will enable the presentation of clear and concise information in an effective and efficient manner, whilst also reducing printing, paperwork and postage expenses.

ACADEMIC INTEGRITY: AUTHORSHIP VERIFICATION

Booth Location: 11

Supervisor: Elizabeth Haywood

Group members: Abhimanyu Asokan, Xi Chen, Zhongfan Dou, Jordan Lo Presti, Shubham Rawal, Shibo Sun, Xiaonan Wang, Jiacheng Wu, Zewen Xu, Fengyan Zhang, Annie Zhou

The project is based on an ongoing research on character level n-gram analysis to perform language agnostic authorship verification. The objective of this project is to create an intuitive platform for educators to perform authorship verification on academic documents produced by students. While tools to detect plagiarism currently exist, this system will identify if a document was actually written by the person who submitted it, based on their previously verified documents.

BUSHFIRE PREDICTION: LEAF LITTER SIMULATION

Booth Location: 12

Supervisor: Elizabeth Haywood

Group members: Jing Bi, Jiacheng Chen, Yudong Gao, Yuanyu Guo, Chao Li, Fan Li, Yanwei Li, Michael Lumley, Marko Ristic, Shalitha Weerakoon Karunatilleke, Ze Wang

Bushfires are frequent events during warmer months, due to Australia's mostly hot and dry climate. They can cause property damage and loss of human life. Predicting bushfires can help members of the community and emergency services prepare for these risks. As a part of a bushfire prediction system, this project aims to simulate falling leaves and measure leaf density. The output will be used by other components of the prediction system for further analysis. Users can decide the amount of leaves to be simulated, choose different types of leaves from a provided database and set a ratio for each selected type of leaf. The simulation can either be visualised for demonstration or as a batch process for statistical research.

MOTIVATIONAL MODELLER

Booth Location: 13

Supervisor: Dr Alex Lopez Lorca

Group members: Evan Cranney, Shuyuan Dang, Sicheng Liu, Jiacheng Sun, Chun Tao, Xinda Yu, Alison Wang, Mingyang Zhang, Ruijing Zhang, Feng Zhao, Xuelin Zhao

This is an eleven-person project team of software engineers building a browser-based tool for constructing motivational models. Motivational models are typically used to clearly articulate (and therefore better understand and validate) the purposes of a business or product, as well as to communicate this to outsiders. Our tool is specialised to make this easy for innovators: firstly, it guides them through a step-by-step process for building motivational models from scratch (based on real academic work); and secondly, it seamlessly handles all the frustrations of rendering and formatting motivational models. This project is being developed in support of a research paper written by a university academic (the client).

NURSE ALLOCATION SYSTEM FOR INTENSIVE CARE UNIT

Booth Location: 14

Supervisor: Dr Alex Lopez Lorca

Group members: Saksham Agrawal, David Barrell, Weixu Chen, Haris Rafique Khan, Qianglin Kong, Jianbo Ma, Hao Mai, Arwinder Singh, Zhenting Wu, Yang Xiong, Sirui Yan

Allogator 2.0 is a nurse allocation system developed for use in the Intensive Care Unit at the Royal Melbourne Hospital. Continuing on from last year's project, this project, takes the basic allocation process further by directly integrating with the hospital's patient management system, handling patient handover notes, strengthening security and creating a more streamlined interface. The software has been developed in close consultation with staff at Melbourne Health to meet the needs of nurses and managers who interact directly with the software many times a day.

iPRO CONNECT: CONTRACTOR MARKETPLACE

Booth Location: 15

Supervisor: Professor Leon Sterling

Group members: Fuqiang Chen, Junjie Huang, Jingyi Li, Hao Liu, Zheping Liu, Ryan O'Kane, Mariam Shahid, Samuel Wong, Yahang Wu, Qian Zhang, Xiaolu Zhang

iPro Connect is an effective, streamlined contractor search tool that helps keep compliance in check. Large organisations have hundreds of contractors working for them and these contractors require various degrees of compliance. For example, some may require police checks prior to undertaking the job.

Sourcing such compliant contractors can be an administrative burden for organisations. Enter iPro Connect! An easy-to-use web application that links contractors and clients who are hiring. Clients can easily search and filter through the large pool of compliant contractor profiles. This saves time and streamlines the process of hiring contractors to meet their specific compliance needs.

ASK IZZY INTERACTIVITY EXTENSION

Booth Location: 16

Supervisor: Professor Leon Sterling

Group members: Jie Fu, Mingran Li, Weikang Li, Jayden Park, Matthew Perrott, Mengnan Shi, Stanley Sim, Ferdinand Swoboda, Chenhao Wang, Zhewei Wang, Qi Yuan

Ask Izzy is a mobile website that connects people who are at risk of or experiencing homelessness to services such as housing, food, health and wellbeing services.

Feedback suggests users would like to see ratings and comments from others and have the ability to provide general feedback to service providers. This project aims to enable users to rate accessibility of services listed on Ask Izzy. The feedback content is moderated and then published on Ask Izzy. This project is partnered by Infoxchange, a not-for-profit social enterprise delivering technology for social justice.

VOLUNTEER ENGAGEMENT TOOL

Booth Location: 17

Supervisor: Dr Gil Tidhar

Group members: Shorye Chopra, Yuan Gao, Jiaxin Li, Zhijin Li, Runfa Lu, Kaven Peng, Nicholas Rosa, Sankar Narayanan Sathyanarayanan, Wenpeng Shao, Huiyuan Zhu

This project aims to create an online app for Stand Up, a non-profit organisation that allows volunteers to track their time and effort spent in volunteering. This tool will also help Stand Up as an organisation to better track, manage and interact with their volunteers.

ARTIFICIAL INTELLIGENCE VISUALISATION

Booth Location: 18

Supervisors: Dr Gil Tidhar

Group members: Chong Hin Chau, Gang Chen, Yi Ding, Hugh Edwards, Sai Hou, Grace Johnson, Mohammed Sharukh Syed, Haoyuan Tang, Yue Wu, Ye Yan, Sunmuyu Zhan

The purpose of our product is to visualise planning solutions in different artificial intelligence problem domains. These domains include logistics, manufacturing, games and puzzles. This is a sought-after solution in both academia and industry. This project has many stakeholders from MIT, IBM, University of Melbourne, King's College London, University of Basel, ANU, University of Huddersfield, NICTA, and ICAPS.

Photographed by: Saint Zaylee Visuals

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Booth No.	Title	Group member(s)	Category
119	Design and manufacture of a flow-respiration chamber	Ashveer Singh Malhotra, Zhanlin Zhang	Mechatronics Engineering
120	Segway-like robot for workshop	Yuichiro Hirose, England Kwok	Mechatronics Engineering
121	Beam rider control for drones	Stephanie Burns, Yuan Lin, Jarryd Rogers	Mechatronics Engineering
122	Interface development for machine learning of automotive calibration priorities	Marco Liu, Minhan Yan, Zongyang Yu	Mechatronics Engineering
123	Solar generation, energy storage, and battery degradation	Ying Ying Beh, Shyam Sundar Shiv Kumar, David William Ripper, Hou Nam U	Mechatronics Engineering
124	Tactile-capable robotic hand design and development	Zhijie Chen, Yangmengfei Xu	Mechatronics Engineering
125	Surgical robot utilising local magnetic actuation	David Marcuson, Rhys Musgrave-Evans, Yudi Ren, Tianhao Wang	Mechatronics Engineering
126	Compliant elbow prosthesis	Fernando Gunawan, Kang Tai, Mun Hoe Wang, Wei Feng Yang	Mechatronics Engineering
127	BONI: prosthetic feedback via bone conduction	Dongqi An, Joshua Guthrie, Justyn Lim, Yi Rong	Mechatronics Engineering
128	Biomechanics of racehorses and detecting limb lameness	Parisa Afshar, Raja Rajeswari Ramkumar, Vu Xuan Le	Mechatronics Engineering
129	Rowing sensor system	Lachlan Wright	Mechatronics Engineering
130	Design of a portable mobile phone charging station for mass displacement in the Pacific	Yogesh Cunniputhur Kumaravel, Arun Cherian Mathew, Ram Charan Teja Thota	Mechatronics Engineering
131	MUR Coordination	Fraser Nicol, Philip Yap	Mechanical Engineering
132	MUR Integration	Ryan Carter, Sai Fairchild, Ambar Srivastava, Tony Zhang	Mechanical Engineering
133	MUR Engine	Vladimir Borzykh, Andrew Gunawan, Gary Li, Xin Lu	Mechanical Engineering
134	MUR Brakes and drivetrain	Aakash Babu Suresh Babu, Sharun Parakattel Benny, Vincent Marciano, Brendan Trinh	Mechanical Engineering
135	MUR Suspension	Will Ellett, Jarod Haegel	Mechanical Engineering
136	MUR Chassis carbon-fibre composite manufacture	Michael Kurnato, Jaideep Singh	Mechanical Engineering
137	MUR Electric motor control	Suya Bai, Lingbeibei Chen, Huaichong Huang	Electrical Engineering
138	MUR Accumulator	Alvin Kurian Augustine, Sohaib Rasheed, Shiyu Zhang	Electrical Engineering
139	MUR Safety systems and data acquisition	Tien Ngo, Mimi Sun, Yida Wu	Electrical Engineering
140	MUR Cooling	Kelechi Okoro, Andrew Seddon	Mechanical Engineering

GET INVOLVED IN ENDEAVOUR AND ENGAGE WITH OUR STUDENTS

Endeavour provides industry with the opportunity to engage and celebrate the achievements of engineering and IT masters students. There are opportunities to sponsor awards, collaborate on real-world projects and network with students at the event.

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To find out more internships, contact **eng-placements@unimelb.edu.au.**

* QS World University Rankings by Broad Subject Area 2018


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